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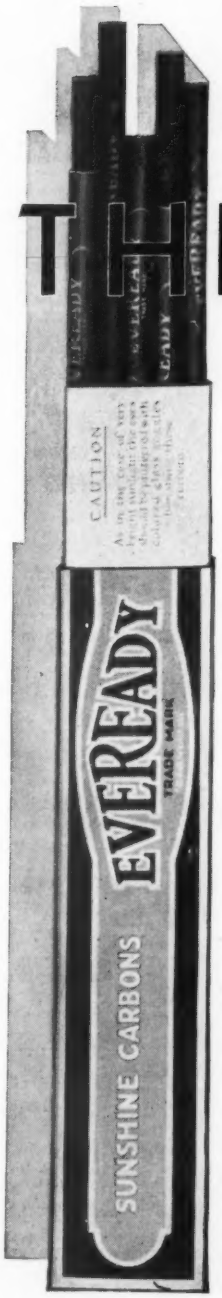

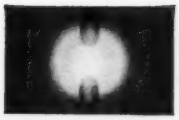

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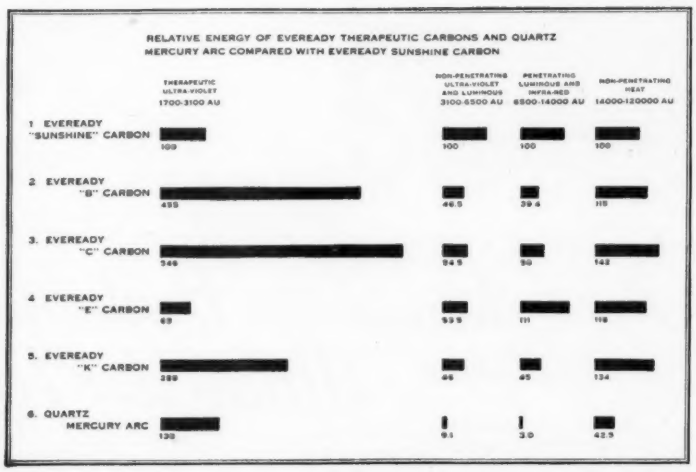
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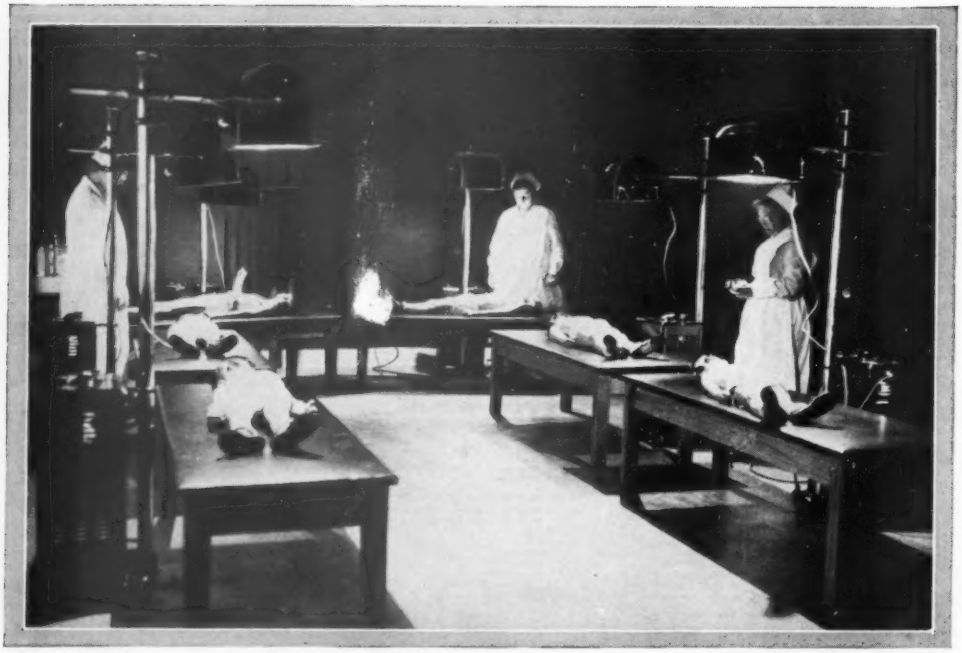

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Supt. Iola-Monroe County (N. Y.) Tuberculosis Sanatorium, in Annual Report

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THE USE OF INTRAVENOUS LEAD IN THE TREATMENT OF CANCER*

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Those of us particularly interested in cancer and its treatment have, within the past two years had our attention directed to the work of Professor Blair Bell of the University of Liverpool, and his method of treating cancer by the use of metallic lead intravenously. Naturally, when any new cancer treatment is advanced the medical profession looks upon it with suspicion. Too frequently the treatment is of a borderline type, such as the "Koch Serum," or the new remedy is not supported by sufficient scientific and clinical evidence to prove its value. It was only when Dr. Francis Carter Wood[1] interested himself in this method of treatment, and showed conclusively by experimental evidence on rat tumors that it had some merit, that I decided to make a first hand investigation to determine for myself whether or not it was a remedy I should care to use on my own patients.

Studying the reports of Professor Blair Bell and his co-workers I was struck by the high standard of their scientific work and their very modest claims of clinical results. Convinced that here was a method of treatment of merit, and fortified in my opinion by such men as Schamberg of Philadelphia and Bloodgood of Baltimore, I decided to visit Bell at Liverpool, and devote whatever time was necessary to make a thorough investigation of the matter. This paper is a report to this society of my investigation. The following is a quotation from one of his recent papers:

> "There is still a considerable danger that if lead be used indiscriminately in the treatment of malignant disease many fatalities will follow, and the method itself, either from excessive caution, or too much zeal, will be brought into disrepute. As we have already demonstrated, we ourselves have had disasters, and although our extensive experience has enabled us to avoid many more similar disasters, it is still quite possible for a patient to lose his life if incomplete investigations be carried out. Any person suffering with the slightest degree of renal impairment or cardiac instability or disease may die most unexpectedly as the result of a single dose. It is therefore incumbent upon us to protect the public as best we can and at the same time to safeguard the reputation of our work. This we feel can best be done by placing the therapeutic agent, when it is available, in the hands only of those who have had some experience of the method and have ample facilities for biochemical and other investigations. This means that if there be a desire in any special clinic to try out the method, a biochemist and clinician be sent to Liverpool to study say, for a week, the methods adopted, especially in regard to the selection of cases and their preparatory examinations. 'Choriotrope,' as we have called the preparation used by us, can only be bought with our permission and this will not be unreasonably withheld."

*Read at the Seventh Annual Meeting, American College of Physical Therapy, Chicago, October 12, 1928.

Lead is very toxic and dangerous and even though (at present) it should only be used in advanced and inoperable cases one cannot ease his conscience in this instance by saying "it won't do any harm even if it doesn't do any good."

The use of intravenous lead in the treatment of cancer is founded on a very substantial theoretical basis, and this theoretical basis is now supported by a mass of scientific data worked out by the Liverpool Cancer Research Organization.

Many years ago Professor Blair Bell, who is head of the Department of Obstetrics and Gynecology of the University of Liverpool, was struck by the similarity, both morphologically and physiologically, between the chorionic epithelium of the trophoblast and the carcinoma cell. Both were much alike in many respects. Both may have a syncitial arrangement, show a tendency to rapid growth, invasion of other tissues, erosion of blood vessels and metastasis. He also noted at an early date, as his earliest publications will show, that lead poisoning causes a specific necrosis in the chorionic epithelium in pregnant animals and produces abortion. He has since shown in rabbits that one-half of the lethal dose of lead given intravenously will produce abortion quite consistently.

Starting from this basis, and believing in the similarity between the chorionic epithelial cell which invades the maternal tissues seeking nourishment, and the carcinoma cell which also invades other tissues for the purpose of seeking nourishment, and having noted the susceptibility of the chorionic epithelium to lead (a property that was not shared by other metals), it occurred to Professor Bell that cancer cells might also be susceptible to the poisoning effects of lead if administered in sufficient amount.

Using at first metallic lead, in a finely divided state, intravenously in several advanced and hopeless cases, some very striking results were achieved—certainly, enough to encourage an extended and intensive study of the method.

In one of these early cases, an extensive carcinoma of the stomach, following the administration of the lead, the patient suddenly died of acute peritonitis, and an autopsy revealed a complete necrosis of the stomach. "Professor Glynn could find no stomach, simply a mass of dead tissue."[2]

Another early case is reported as follows:[2]

> "On November 9, 1920, a woman was admitted to my maternity ward at the Royal Infirmary, Liverpool, for her confinement which took place a few days later. She was suffering with an extensive ulcerated carcinoma of the left breast with glands in the axilla. Operation had been considered useless six months previously by two of my surgical colleagues. The growth had been accelerated during pregnancy, as is usual in these circumstances. I was looking for just such a hopeless case.
>
> "A section was prepared from a piece of tissue adjacent to the ulcerated area, and intravenous injections of lead were given. Not only is the patient well today, five years later, but also she has had two more babies in the interval, both of whom she has suckled at the breast that was affected."[3]

These and several other instances were so striking that three years ago the Liverpool Cancer Research Organization was formed. The funds were furnished by several Liverpool citizens, and, more recently, all funds received as fees from private patients for consultations, examinations, injections and hospital care have been taken over by this committee. This body defrays the expenses in connection with both the clinical work and laboratory investigations. Certainly, no one can accuse Professor Blair Bell and his co-workers of mercenary motives.

The organization is made up of the heads of the various departments in the University of Liverpool, whose special knowledge could be brought to bear upon the different aspects of the problem, and under these department heads, full and part time research workers and clinicians are employed. About fifty reports have been published by the orgnization, and, as the work is well coordinated under the direction of Professor Blair Bell, a great deal has been accomplished in the fields of chemistry, biology, pathology, animal experimentation, pharmacology, and clinical medicine and surgery. There still remains, however, a great deal more to be done, and it is to be sincerely hoped that sufficient funds will continue to be available to keep this organization together to investigate the different phases of this problem.

The main thing now is the perfection of a lead compound with increased affinity for the cancer cell, and decreased affinity for normal cells, comparable to salvarsan in its relation to the spirochaete and the tissues and cells of the host. Up to the present time over fifty preparations have been tried out and little or no progress along this line has been made.

The problem I am quite sure, however, is capable of solution with increasing knowledge of the pathophysiology of cancer.

Let me refer, briefly, to some of the steps that have already been taken along this path that point, I believe, the way to future advances along this line. As stated above, there are a number of things about the cancer cell that indicate a behavior similar to the cell of the chorion: invasion, erosion, rapid growth, multiplication, and metastasis. There are other similarities, particularly chemical and physiological.

Blair Bell believes the cancer cell to be not an "undifferentiated" cell but a "de-differentiated" cell, a reversion to an ancestral type forced upon it, and this reversion is similar to that seen in all evolutionary processes in nature, and, like these reversions, it is the result of adverse living conditions and increased difficulty in seeking nourishment.

Elaborate experiments have been carried out by Professor Lewis and his associates which show quite clearly that the cancer cell and the chorionic cell have a similar degree of permeability (which indicates a similarity in capacity for growth and multiplication), and that the cancer cell is like the chorionic cell, and unlike the normal somatic cell, or the cell of benign growths, in that it has a very high phosphatid or lecithin content, and a comparatively low cholestrol content. Professor Lewis has also confirmed Warburg's remarkable discoveries. Warburg has demonstrated that the cancer cell differs from the normal cell in its ability to utilize oxygen.

The normal cells take up oxygen and give off CO_2—a normal respiratory capacity. The cancer cell, however, even in the presence of oxygen does not have this capacity, but derives its energy by splitting glucose with the formation of lactic acid. A cancer may have five times as much lactic acid as the surrounding normal tissues. Lewis has found that this same type of impaired respiratory capacity is seen in the chorionic epithelium.

These scientific discoveries have an extremely important bearing upon the selective action of lead on both the chorionic epithelial cell and the cancer cell for the following reasons: Lead, when introduced into the circulation, is in all probability converted into the tribasic phosphate, either in the blood stream, or in the tissues. In the presence of increased acid, such as found in the cancerous tissues, the tribasic phosphate, which is comparatively insoluble, is converted into the acid phosphate, which is many times more soluble and toxic, and causes an increased local toxic effect. Thus the question immediately presents itself: Why not use the less toxic lead phosphate? This is being done at present, but sufficient time has not elapsed to reach a conclusion regarding its value. Up to the present time over fifty modifications of the original lead preparation have been tried, and most of them have been found to be inert, or too toxic for practical use.

Until Blair Bell and his group have tried out the lead phosphate I do not feel like using it because of the failure of so many other lead compounds. He, and he only, is competent to judge of its relative value. He told me he would probably be in a position to report on it in the course of six or eight months.

Let me report to you the plan of treatment worked out at Liverpool. First, as to the selection of cases. Let me quote Dr. L. Cunningham, assistant director of the Liverpool Cancer Reserch Organization.[4]

> "In treating malignant disease with lead one of the greatest difficulties with which we have had to contend has been the selection of those cases which present a reasonable chance of being benefited and which at the same time are likely to withstand the toxic effects of the therapeutic agent employed. There are, of course, certain obvious contra-indications to treatment among which must be mentioned gross pathological lesions of one or more of the important organs of the body, and serious cachexia of the patient. We have been brought face to face, however, with another problem, namely, the idiosyncrasy of the individual, which unfortunately discounts to a certain degree the

investigations of the vital functions of the body, upon which, nevertheless, we lay considerable stress. We are unable to explain how it is that, other things being equal, some patients, for no apparent reason, are unaffected by large doses of lead, whereas others are made very ill, and may even die after a moderate dose.

"It has been our practice before undertaking the treatment of cases to make a complete analysis of the blood and urine, apart from the careful medical examination of the important organs of the body. We also make use of radiological studies where these are likely to be of assistance in diagnosis, and in determining the extent of the disease. These investigations are carried out from time to time in the course of treatment; in particular, observations are repeatedly made in regard to the blood and urine.

"In case of the blood, full counts are made of the red and white corpuscles, and the percentage of haemoglobin is estimated. The blood urea is also determined, and in certain cases the blood sugar in the course of treatment is determined. We examine regularly, in the course of treatment, blood films for stippling of the red cells, and this has been of great value in determining not only the dose of lead which should be given at any period but also the interval which should be allowed to elapse before a further dose is given. We usually suspend treatment when there is more than one stippled cell per field, even in the absence of any other contra-indication."[4]

I found, in observing the work at Liverpool, that the blood examination for stippling of red cells was the one most important guide to treatment—the usual clinical signs of lead poisoning as seen in industry, such as lead line on the gums, headache, wrist drop, and colic, while at times present were by no means constant or regular in their appearance.

The most important contra-indications to treatment were (a) myocarditis ,(b) hypertension, (c) renal impairment, and (d) anaemia—hemoglobin less than 50% or red cells less than three million.

The preparation of lead that has been most consistently effective is a metallic suspension in gelatin prepared by the sparking method of Bredig.[3] Until some better preparation is perfected, and has the approval of the Liverpool Organization, I do not believe in using any other lead preparation. Most of the lead compounds so far tried out have been found to be either too toxic, or inert in their action. However, I feel very sure that with further study, particularly of the pathophysiology of the cancer cell, and the pharmacology of lead compounds, a preparation will be found with increased affinity for the cancer cell, and decreased affinity for the normal cell.

The lead suspension is prepared as follows: Silver free lead (assay lead) is melted and poured from a low height (a few inches) into water to form small shot-like masses. A handful of this lead is put into a large evaporating dish about eight inches in diameter with 500 c.c. of the sparking solution which is one-half per cent "Difco" solution of gelatin, containing 5 c.c. of two per cent solution of calcium chloride per 500 c.c. The lead is sparked with either a direct or alternating current for about fifteen minutes. The current is reduced by placing five 600 watt conical resistances arranged in multiple down to 30 amp. at about 60 volts. The poles are bars of commercial lead, about one-fourth inch in diameter, and about eight or ten inches long, made of rolled sheet lead (assay lead). These are stirred about in the "shot" for about fifteen minutes, or until the solution is quite black; decant into flask and cool in running water. The supernatant solution is syphoned off into a flask, and centrifugalized lightly (1760 R. per minute) for three or four minutes. A portion of this is poured off for assay for its lead content. Assay and bring to 500 mg. per 100 c.c., then add salt to make 1.1 per cent, then boil.

Colorimetric method for determining lead in colloidal solution: 5 c.c. of the colloidal lead solution which is ready to be injected is placed in a 500 c.c. graduate and 2 or 3 c.c. of concentrated nitric acid added to make the solution clear. Make up to 50 c.c. volume with distilled water and mix. 5 c.c. of this placed in 100 c.c. graduate and shaken gently with 5 c.c. to 10 c.c. of a saturated solution of sodium acetate. Dilute to 50 or 60 c.c. and 3 c.c. of freshly prepared one-half per cent gelatin solution and mix. Develop brown color with 5 c.c. or more of hydro-

gen sulphide water and make up to 100 c.c. At the same time a standard is prepared as follows:

Five c.c. of standard solution of lead acetate containing 2 mgs. of lead to 5 c.c. are placed in another graduate and after adding two or three drops of nitric acid, the sodium acetate is also made up to 50 or 60 c.c., 3 c.c. of gelatin solution added and the color developed with fresh hydrogen sulphide. Bring to 1000 c.c. The colors are then compared in a colorimeter. The calculation is made as follows:

$$\frac{\text{Reading of standard} \times \text{amt. of lead in standard} \times 200}{\text{Reading of unknown}} = \text{mgm. of lead per 100 c.c.}$$

$$\text{Example: } \frac{30 \times 2 \times 200}{24} = 500 \text{ mgms. of lead}$$

In sparking the solution it seems to help to have the gelatin cold and then to place the evaporating dish in a container of cracked ice.

After the suspension is prepared it is put in glass bottles with ground glass stoppers (previously sterilized), and the bottles filled to the top and promptly stoppered, as the preparation oxidizes very rapidly to form lead hydroxide, the most poisonous of the lead compounds.

The suspension should be used within 72 hours, and is always given intravenously. The first two doses are usually 75 mg.; the amount is then reduced to 50 mg. for the next two doses, and then 25 mg. for each of the succeeding doses, until a total of 500 mgs. is reached. The interval between injections is usually seven to ten days, but the chief guide to dosage and interval is the blood examination.

The reaction to the treatment is variable—it may be local, or general, or both. Usually the patient complains of pain at the site of the tumor within a few hours after the injection, and this pain may be accompanied by swelling and edema. The general reaction affects the blood and blood forming organs, with the production of anaemia and stippling. There may be more or less disturbance of the gastro-intestinal tract (chiefly colic), the liver (icterus), kidney (albuminurial), and suppression of the urinary output. Blue line on the gums is rather rare.

Toxic effects on the central and peripheral nervous systems are extremely rare. The anaemia produced by the lead is treated by injections of iron arsenite and, when necessary, by blood transfusion. In severe colic, morphine and atropine is used.

The results of treatment are not startling, except in isolated cases, but I believe they are encouraging when one considers the class of cases treated. Since November, 1920, until November, 1925, 227 cases received treatment and these may be tabulated as follows:

DATE OF PATIENTS NOVEMBER 9, 1920, TO NOVEMBER 9, 1925

Died before treatment could be completed	50
Died of intercurrent infections	3
Died after treatment (including 2 deaths from acute nephritis, the result of lead poisoning)	106
Died as result of extensive destruction of growth by lead	4
Too recent for results to be estimated	14
Complete treatment refused, but patients are living normal lives	9
Disease completely arrested	10
Believed cured and treatment stopped	31
	227

The percentage of success is therefore about 20 per cent, and considering the class of cases treated this is significant.

With improvements in methods which surely will come, with the improvement in class of cases treated which will be justifiable only when the dangers of the treatment are removed, with the employment of lead therapy in conjunction with other well known and reliable methods of treatment, such as surgery, electrocoagulation, and x-rays and radium, I am convinced that lead will come to occupy a definite and accepted place in our list of weapons against this disease.

For the present, certainly, its use is limited, and, as in the case of x-rays and radium, overenthusiasm has no place. The promiscuous injection of lead into patients' veins without proper study and care can only cause harm and react

against a treatment that has limited but definite value.

Lead has been shown by Blair Bell clinically, and by Frances Carter Wood experimentally on rat tumors, to have a destructive effect on cancer cells.

X-rays and radium have long been known to possess similar properties.

A combination of the two should produce better results than either one alone; in fact, in the present state of our knowledge, lead may very properly be considered a useful adjunct of radiation and surgery.

[1]W. Blair Bell, British Medical Journal, Nov. 20, 1926.

[2]W. Blair Bell, The Lancet, November 14, 1925. Page 1003.

[3]W. Cm. M. Lewis, British Med. Journal, Nov. 20, 1926.

[4]L. Cunningham, British Medical Journal, Nov. 20, 1926.

THE EFFECT OF MERCURY VAPOR LIGHT IRRADIATION UPON THE VASCULAR SYSTEM*

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Therapeutists generally agree that there is a decided advantage in the use of several drugs over any single remedy. Recently, many new and useful agents have been advanced as weapons in combating physical disorders. Newer chemical compounds and physical agents, which form an important part of a physician's armamentarium, are indispensable in therapeutic attacks on microbic infections. Thus, by chemotherapy, it is possible to overcome and, in many instances permanently cure, infections that were at one time looked upon as hopeless.

Powerful spirocheticides have prolonged the lives and improved the health of many patients afflicted with syphilis. Yet, it becomes apparent, that while therapeutics has undergone tremendous development within the last decade, no single drug can be depended upon as an absolute specific for all patients. Those individuals who have strongly positive Wasserman reactions refractory to the arsenicals often fail to improve at least serologically when other antileutic compounds are substituted.

The discovery of insulin has cleared the skies for the diabetic, the use of liver extract in pernicious anemia promises untold advantages over those remedies employed empirically; various derivatives of barbituric acid have largely replaced the one time honored use of the bromides; ephedrin rivals adrenalin, although the former is not so rapid in its action as the familiar secretion derived from the suprarenal glands. Recently newer spirocheticidal drugs have been added to the list of the syphilologist. The use of bismuth salts, popularized by Levaditi and Sazerac in 1921, transformed a drug heretofore largely employed as a gastro-intestinal sedative and astringent, to a powerful anti-leutic, far superior to mercury and almost equal to that of arsphenamine. Prophylactic sera, vaccines, antitoxins, as well as non-specific proteins form another chapter in recent advances of therapeutics.

It is comparatively within recent years that the profession has become cognizant of the important role that light plays in therapeutics. From a survey of the valuable results obtained by means of various forms of light rays, one may safely predict that the pharmacopeia of the future will not confine itself to the mere use of medicinal and chemical remedies, but will include various forms of light, such as infra-red, ultra-violet, gamma rays of radium and other physiotherapeutic procedures.

Probably the future medical and pharmaceutical student will be expected to know more

*Read at the Seventh Annual Meeting, American College of Physical Therapy, Chicago, October 11, 1928.

about the physical and chemical properties of light, which, until the present time, has been a sadly neglected branch in most schools. The appointment of a commission by the American Medical Association to deal with this important branch of medicine is a step in the right direction. One may go a step further in assuming that the future therapeutics will call for various forms of light and heat rays, which a trained technician or pharmacist may be called upon to administer much in the same manner as prescriptions are now compounded. Several schools in England have already started training technicians in ultraviolet therapy and it is not improbable that before long similar studies will be begun in this country.

Among medical attendants there are those who are ever eager to condemn light therapy. Curiously enough, many of the physicians who are skeptical in the use of ultraviolet have never employed irradiations, or, having resorted to the use of the rays, are not entitled to judge the merits of artificial heliotherapy from the comparatively few cases studied. Painstaking researches of many eminent physiotherapists in this country and abroad are too valuable to be entirely ignored. There is scarcely a branch of medicine which has not been invaded by ultraviolet. Specificity of the rays has repeatedly been demonstrated in rickets, spasmophilia and tetany. The efforts of Hess, Unger, Pappenheimer, and others are noteworthy in this respect. Hazen has called attention to the value of ultraviolet in pityriasis rosea. Psoriasis sometimes lends itself to the cure from routine exposures to the sun rays.

One marvels at the beneficent results obtained from artificial heliotherapy in treating stubborn cases of herpes zoster. Staphylococcic infections of the skin respond beautifully to short rays of ultraviolet. In the use of mercury vapor quartz light, the therapeutist now has another agent, equally effective as mercurial compounds and gentian violet in the treatment of impetigo.

Chronic bronchitis in the child and adult are remarkably benefited by systemic exposures to ultraviolet. The light has also been serviceable to the surgeon in healing burns and in repairing fractures. The neurologist finds the artificial beams of sunlight valuable as a sedative. Galactogogue properties have been attributed to ultraviolet. If further research proves irradiations cause an increased flow of milk during and after the puerperium, then one of the greatest usefulness of ultraviolet will have been established, since there are few true galactogogues. In a series of patients studied by Stolte and Wiener,[1] excellent results were obtained in a group of twenty lactating mothers.

Those who believe that ultraviolet has fallen short of its reputed value, and who likewise contend that light rays have not met the expectations of therapeutic idealism, we should like to remind that the zenith of therapeutic idealism has as yet not been achieved through the use of drugs. The tendency at present is unquestionably specificity: that is, fewer drugs of greater therapeutic efficiency. Clinical experience with mercury vapor quartz light has established its wide range of usefulness in a great many disorders not benefited by drugs. Contrary to earlier investigations with ultraviolet therapy, when irradiations were employed very much with the "hit or miss" objective in mind, not unlike the old time polypharmaceutical or "shotgun" prescription, careful research has proven the rationale of ultraviolet. Its use, therefore, has largely replaced empiricism.

Modern physiotherapeutists are now guided by well defined principles, indications and contraindications for the use of artificial heliotherapy. The rays are no longer employed as a panacea. Treatment by quartz light has reached that degree of therapeutic nicety and exactness when many conditions formerly unaffected by standard routine therapeutics can be relieved; and in many instances it can be depended upon to effect a so-called "cure" by routine exposures. It is true that many new fields of research have been entered by the introduction of light therapy. While a great deal remains to be accomplished particularly in regard to the standardization of

dosage, ultraviolet light has undoubtedly proven its value both to the physician and chemist.

Physical agents are often more valuable than drugs. This is not because difficulty is encountered in administering remedies by mouth, but for the reason that many drugs are not tolerated during early life. It is a dictum in all therapeutics, never to administer medicinal agents unless there is strong indication for their use. Rest, good food and fresh air constitute the keynote upon which natural immunity and recovery depend. In the young, hydrotherapeutic measures are preferred to antipyretic drugs, although the latter are often found useful when a sedative effect is desired. Physical agents therefore become indispensable to the pediatrician when medicines are administerd with difficulty. One of the outstanding features of ultraviolet medication is the tonic effect upon the nervous system. When properly administered to individuals, suffering from malnutrition, there is often a gain in weight. Because of this constructive property, ultraviolet irradiations are sometimes referred to as food rays.

In the treatment of anemias of secondary origin, light therapy possesses many advantages over iron compounds. Several authorities including Langstein (L. Langstein, Deutsche. Med. Wchnschr. Nov. 22, 1928) have deplored the indiscriminate use of liver diet in the treatment of secondary anemia. As far as can be ascertained from the use of liver extract in secondary anemia this therapeutic regime is not only worthless, but as several therapeutists point out, when prescribed for infants liver diet is liable to produce putrefactive diarrhea with loss of appetite and fever.

DIFFICULTIES ENCOUNTERED IN ADMINISTERING IRON PREPARATIONS TO CHILDREN

When organic and inorganic iron compounds are called for, the use of medicinal preparations by mouth or hypodermically often fails to meet theoretical expectations. As is well known persuasive measures are often necessary when drugs are administered to children. This difficulty becomes a real one particularly in young children between the ages of three and ten years. It has been the experience of many pediatricians that infants refuse their customary feedings, when once they have been misled by an attempt to disguise an unpleasant tasting medicine when the latter is added to food. This, however, is a minor disadvantage when compared to other obstacles. Admitting that obstreperous infants can be forced to ingest medicine in liquid forms (not always the best means for administering drugs) by one of several ingenious devices, one questions the wisdom of forcibly administering such agents over a prolonged period of time. Habitual vomiting, too often the result of such practices, is not an easy matter to overcome. Among the more serious objections that may be raised to the use of iron in infants and children are a disagreeable taste particularly common to the liquid preparations, the constipating property, and the deleterious effect upon teeth, unless certain precautions are exercised in its administration. A disordered state of digestion often arises from prolonged administration of iron compounds. Iron salts, as a general rule, must be administered in fairly good sized doses in order to be effective. Thus Bass and Denzer recommend as much as thirty to sixty grains of saccharated ferrous carbonate per day for secondary anemia, an unusually large dose for most children when we consider that the adult body contains about twenty grains of iron. The question naturally arises, is it possible that those therapeutists who administer massive doses of iron expect the intestines to absorb the required amount much in the same manner as a sponge absorbs water?

The hypodermic method of introducing iron into the body, while more reliable than oral administration, has many disadvantages in children, which detract from its practical usefulness. Aside from the objection on the part of parents who naturally dislike to have their children "repeatedly stuck with needles," there is certainly no good excuse nor better means of antagonizing the good will of smaller children than by this means of therapy. Furthermore, hypodermic medication adds to a highly nervous state and the unpleasant after effects necessitated by

the subcutaneous injections of iron compounds are not readily forgotten.

Blood transfusion while a life saving device, undoubtedly of value in severer grades of anemia, is unjustifiable as a standard procedure in all patients. Blood transfusion has not met with popularity, since by many patients it is regarded as a procedure of last resort. There is the added difficulty of securing the services of a suitable donor; it is expensive, and as such detracts from its ready application. It is obvious from the few arguments advanced, that iron therapy as employed at the present time for anemia is far from practical. Therefore, those methods which serve to overcome any of these disadvantages become worthy of considerable thought and support from the profession.

REVIEW OF LITERATURE

Recently investigation with ultraviolet light upon the vascular system has unfolded a great deal of interesting data of practical value to the clinician.

Sanford,[2] in a study based on the observations of two hundred newborn infants during a period of eight months, found that short exposures to ultraviolet light increased the hemoglobin content and number of red cells to a slight extent in an average number of cases, but there was a rapid return to normal. The same authority found that when the hemoglobin and red cells were lower than normal, short exposures to ultraviolet not only increased these elements, but that they had a tendency to remain nearly normal.

Trixier[3] emphasizes the fact that ultraviolet rays are without effect in pernicious anemia, but of value in secondary anemias of medium intensity. Trixier observed that the influence of ultraviolet light is manifested not only upon the blood but also upon functional signs. Trixier adds that anemia in children from rickets, lues, malnutrition, hemorrhges in convalescence, may be benefited by the rays; but tuberculous anemia does not yield to treatment by means of ultraviolet.

Traugott[4] studied the action of ultraviolet radiations on the number of the blood constituents, on the relative division and on the coagulation time. He found the number of blood cells was unaltered, but that the leukocytes increased after sufficiently long action of ultraviolet rays. The increase in blood constituents was maintained and even became greater during the first half hour, but was transient and had completely disappeared at the end of six hours. In Traugott's series of patients, ultraviolet rays quickened the coagulation of blood and increased the blood platelets.

Palmieri[5] irradiated blood from patients with tuberculosis of the skin. When whole blood was treated, ultraviolet exposures produced at first (15 minutes) an increase, later (30 minutes) a decrease of the phagocytic index. Irradiation of the leukocytes alone inhibited phagocytosis.

Barenberg and Lewis,[6] as a result of irradiations upon the blood stream of infants, concluded that the number of erythyrocytes and leukocytes did not seem to be affected. An increase in the number of polymorphonuclear cells was obtained among those of the irradiated group, during the first and second periods. The hemoglobin percentage of the irradiated group was maintained during the first period, whereas a fall of 12% was noted in the non-irradiated group.

Aschenheim and Meyer[7] failed to find any increase in the polymorphonuclear cells after irradiation, while Gelera's[8] study is directly opposite in results to that of the Aschenheim and Meyer's investigation. Gelera observed an increase in the polymorphonuclear cells after radiation.

Miles and Laurens[9] demonstrated that with heavy ultraviolet irradiations in dogs there is first an increase, followed by a drop in neutrophiles.

Clark's[10] survey is of interest in connection with ultraviolet irradiations upon white blood cells. Clark states that ultraviolet rays, shorter than 3000 angstrm units, result solely in a great decrease of the lymphocytes, while the polymorphonuclears remain constant. The near ultraviolet rays just below the visible portion of the

spectrum have a depressing effect on the lymphocytes, but give rise to an increase of short duration in neutrophiles which is followed by a decrease below normal. These observations led Clark to conclude, that daily quartz light irradiations for more than four weeks with routine exposure, time, and distance, in the majority of cases examined, result in a lowered bactericidal property of the blood. The same authority states that normal persons, free from any infection, are apt to show improved bactericidal properties after continuous ultraviolet irradiations. Post infectious conditions, after daily quartz lamp treatments, are apt to show a drop in the bactericidal property of the blood.

The increased or reduced bactericidal property of the blood after ultraviolet irradiation seems to depend largely on the leukocytic reaction of the body. An increased number of white blood cells, especially of polymorphonuclears, is associated with improved killing power for cocci.

Redfield[11] believes ultraviolet ray increases the blood calcium and stabilizes it. Absorption of the rays into the blood stream causes an increase in the number of red blood cells, white blood cells and the percentage of hemoglobin. Ultraviolet rays increase the bactericidal power of the blood and also cause an absorption of phosphorus and calcium from the intestines. The coagulation time is shortened under ultraviolet radiation.

Azzi's[12] experiments deal with the action of ultraviolet rays in bacteric phagocytosis and is important from an immunologic standpoint. Azzi observed that staphylococci exposed for a brief time to the action of ultraviolet rays are more easily and more rapidly destroyed by human polymorphocytes than when untreated.

According to Schubert,[13] the absorption of ultraviolet rays by the skin depends upon the presence of anemia. This observation is important from a physiologic standpoint, since it is quite probable that results depend upon this phenomenon. Schubert tested the amount of absorption of ultraviolet rays by comparing the reflected rays with the original radiation. He found that a skin which had been rendered anemic absorbed much less than a normal skin. This peculiarity Schubert attributes to a strong absorption of the rays (especially of the wave lengths below 302) by the hemoglobin.

SCOPE OF STUDY

The study of the effect of the mercury vapor quartz light upon the vascular system was approached from two angles. The first concerned itself with the effect of the light upon the individual blood elements, found in various disordered states for which patients were referred to the department for treatment. The blood counts of all patients selected for this study revealed a secondary anemia.

The second half of the experiment was in a sense an analytical survey to determine the effects upon the blood constituents that followed from short, moderate and prolonged exposures.

The routine practiced for generalized exposures in the Artificial Heliotherapy Division of the Pediatric Department at the Jefferson Hospital consists in irradiating the entire body upon the anterior and posterior aspects for an equal number of minutes. Treatments begin with one minute and are increased in duration on alternate days until a total of fifteen minutes are reached at regular tube distance (40 inches). After the fifteenth exposure, the tube distance is gradually lowered toward the skin surface (one inch at each successive treatment) until the quartz tube measures one foot from the body of the patient. The maximum tube distance is one foot from the body and the maximum exposure under this technic is fifteen minutes anteriorly and posteriorly. This procedure is continued irrespective of the number of exposures patients receive until they are discharged. Excessive tanning of the skin and burns are cautiously guarded against by employing trained technicians who by experience know when to increase and decrease or discontinue irradiations.

The study included 18 infants and 55 older children. Their ages ranged between 2 and 13 years, 41 were males, 32 were females. The fol-

lowing are conditions for which ultraviolet therapy was administered: Malnutrition, 26; chronic bronchitis, 27; infantile rickets, 7; esophageal stenosis, 4; laryngeal stenosis, 3; eczema, one; bronchietasis, one; secondary anemia (cause—intestinal parasites?), one; nephrolithiasis (tonic-effect), one; pylorospasm, one; enterospasm, one. All were white children.

TABLE I.

LARYNGEAL STENOSIS

Total Number Patients—3

	Increased	Decreased	Unchanged
Hemoglobin	2	1	0
Red blood cells	2	1	0
White blood cells	2	1	0
Polynuclears	1	2	0
Small Lymphocytes	0	3	0
Large Lymphocytes	2	1	0
Transitionals	0	0	3
Eosinophiles	1	1	1

Three patients, two males and one female, were treated for laryngeal stenosis. The youngest patient was three years, the oldest four years. Results obtained are recorded below.

Hemoglobin—Increased in two patients minimum 7%, maximum 10%); decreased in one (17%).

Red Blood Cells—Increased in two patients (minimum 100,000, maximum 120,000); decreased in one (300,000).

White Blood Cells—Increased in two patients (minimum 2,000, maximum 6,200); decreased in one (5,400).

Polymorphonuclear Leukocytes — Increased in one patient (18); decreased in two patients (minimum 2, maximum 5).

Small Lymphocytes—Decreased in all three patients, (4, 12 and 30 cells respectively).

Large Lymphocytes—Increased in two patients (each 14 cells); decreased in one (4 cells).

Transitional—These cells were neither increased nor decreased from the light exposures, since the transitional cells were not discovered either before or after irradiations.

Eosinophiles—Increased in one patient (one cell); decreased in one patient (two cells); unchanged in one patient (no cells).

SUMMARY

The hemoglobin, red, white and large lymphocytes cells were each increased in two instances and decreased in one instance. The polynuclears were increased in one patient and decreased in two patients.

The following are the remaining changes observed. Small lymphocytes decreased in three patients, transitionals were unchanged in three instances; eosinophiles increased in one patient; decreased in one patient and remained unchanged in one individual.

CONCLUSION

Mercury vapor quartz light irradiations in three patients treated for secondary anemia, all subjects of laryngeal stenosis, were benefited inasmuch as the hemoglobin, red and white blood cells were concerned. The differential cellular elements were more frequently depressed than stimulatd in this group of patients studied.

TABLE II.

ESOPHAGEAL STENOSIS

Total Number Patients—4

	Increased	Decreased	Unchanged
Hemoglobin	2	2	0
Red blood cells	3	1	0
White blood cells	1	3	0
Polynuclears	0	4	0
Small Lymphocytes	2	2	0
Large Lymphocytes	2	2	0
Transitionals	0	1	3
Eosinophiles	1	0	3

Four patients received exposures for esophageal stenosis. There were three males and one female, the youngest child was three and a half years, and the oldest six years. The following results were obtained in this series of patients:

Hemoglobin—Increased in two patients (minimum 8%, maximum 11%); decreased in

two patients (minimum 10%, maximum 23%).

Red Blood Cells—Increased in three patients (minimum 400,000, maximum 450,000); decreased in one patient (1,000,000).

White Blood Cells—Incresaed in one patient (1,800); decreased in three patients (minimum 600, maximum 1,600).

Polymorphonuclear Leukocytes—Decreased in all patients (minimum 8, maximum 14).

Small Lymphocytes—Increased in two patients (minimum 10, maximum 12); decreased in two (minimum 2, maximum 3).

Large Lymphocytes—Increased in two patients (minimum 3, maximum 3); decreased in two (minimum 2, maximum 4).

Transitionals—Unchanged in three patients (two, no cells present, one, three cells); decreased in one patient.

Eosinophiles—Increased in one patient; unchanged in three (no cells present).

SUMMARY

The hemoglobin was decreased as frequently as it was increased. The red blood cells increased three times as often as it was decreased; while the white blood cells decreased three times in proportion to the increase. The polynuclears were decreased in all four patients; the small and large lymphocytes increased and decreased in equal proportions; while in three instances the transitionals and eosinophiles remained unchanged. An increase in the eosinophiles followed in one patient while a decrease in the transitionals occurred in another patient of this series.

CONCLUSION

There were no marked changes observed in the blood constituents in this small group of patients studied. In general a favorable influence was seen to occur in the hemoglobin and red blood cells while the differential blood constituents seemed to remain unchanged or were otherwise decreased in numbers.

TABLE III.

CHRONIC BRONCHITIS

Total Number Patients—27.

	In-creased	De-creased	Un-changed
Hemoglobin	17	9	1
Red blood cells	19	8	0
White blood cells	17	9	1
Polynuclears	17	9	1
Small Lymphocytes	19	8	0
Large Lymphocytes	15	9	3
Transitionals	5	7	15
Eosinophiles	3	9	15

Twenty-seven patients were treated for chronic bronchitis, of this number eleven were females and sixteen male infants and children. The youngest patient was thirteen months, the oldest nine and one-half years. The following results were obtained from generalized irradiations:

Hemoglobin—Increased in seventeen patients (minimum 2%, maximum 32%); decreased in nine patients (minimum 2%, maximum 30%). In one patient the hemoglobin remained unchanged (76%).

Red Blood Cells—Increased in nineteen patients (minimum 20,000; maximum 1,400,000); decreased in eight patients (minimum 100,000, maximum 1,300,000).

White Blood Cells—Increased in seventeen patients (minimum 100, maximum 400,000); decreased in nine patients (minimum 500, maximum 3,600). In one patient the white cell count remained unchanged (17,400).

Polymorphonuclear Leukocytes—Increased in seventeen patients (minimum 4, maximum 18); decreased in nine patients (minimum 3, maximum 22). In one patient these cells remained unchanged (68).

Small Lymphocytes—Increased in nineteen patients (minimum 1, maximum 23); decreased in eight patients (minimum 2, maximum 22).

Large Lymphocytes—Increased in fifteen patients (minimum 1, maximum 15); decreased in nine patients (minimum 2, maximum 8). In three patients these cells remained unchanged.

Transitionals—Increased in five patients (minimum and maximum, each 1); decreased in seven patients (minimum 1, maximum 2); unchanged in fifteen (no cells).

Eosinophiles—Increased in three patients (minimum 1, maximum 3); decreased in nine patients (minimum 1, maximum 2); unchanged in fifteen patients (0 to 3).

SUMMARY

In the majority of patients the hemoglobin, red blood cells, white blood cells, polynuclears, small and large lymphocytes were definitely increased, while the transitionals and eosinophiles were decreased. The last two mentioned types of cells remained constant in about half the series of patients who were irradiated.

CONCLUSION

The majority of patients fared well from mercury vapor quartz light irradiations. Apart from the favorable influence upon the blood elements, appetite and muscular tone improved. A general state of well being was also observed and the characteristic cough symptom disappeared. These results were in all probability dependent upon an increase in the various blood constituents which aided the patient's resistance.

TABLE IV

RICKETS

Total Number Patients—7

Hemoglobin	3	4	0
Red Blood Cells	2	5	0
White Blood Cells	5	2	0
Polynuclears	5	2	0
Small Lymphocytes	5	2	0
Large Lymphocytes	5	1	1
Transitionals	1	0	6
Eosinophiles	2	1	4

Seven patients were irradiated for infantile rickets. There were six males and one female. The youngst rachitic infant was five months, the oldest three years. The following results were obtained:

Hemoglobin—Increased in three patients (minimum 7%, maximum 18%); decreased in four patients (minimum 2%, maximum 23%).

Red Blood Cells—Increased in two patients (minimum 600,000, maximum 700,000); decreased in five patients (minimum 350,000, maximum 1,850,000).

White Blood Cells—Increased in five patients (minimum 400, maximum 12,000); decreased in two patients (minimum 3,000, maximum 4,200).

Polymorphonuclear Leukocytes — Increased in five patients (minimum 4, maximum 31); decreased in two patients (minimum 10, maximum 11).

Small Lymphocytes—Increased in five patients (minimum 5, maximum 28); decreased in two patients (minimum 16, maximum 23).

Large Lymphocytes—Increased in five patients (minimum 1, maximum 26); decreased in one patient (10 in number); unchanged in one patient (2 cells).

Transitionals—Increased in one patient (2 cells); unchanged in six patients (no cells were observed before or after irradiations).

Eosinophiles — Increased in two patients minimum 2, maximum 3); decreased in one patient (1 cell); unchanged in four patients (remained negative in cell count).

SUMMARY

In the group of patients studied the hemoglobin was decreased in slightly more than half the number of patients; the red blood cells decreased in five patients, with distinct increase in the white blood cells, polynuclears, small and large lymphocytes. In six patients the number of transitional cells remained unchanged, while the eosinophiles remained unchanged in four instances.

CONCLUSION

The blood chemistry of ultraviolet irradiations in rachitic children is too well known to deserve repetition at this time. In general, it may be stated that mercury vapor quartz light exposures upon the blood cells tend to cause a

depression of the hemoglobin and red blood cells, and an increase in the white blood cells, polynuclears, small and large lymphocytes. The transitionals and eosinophiles remained unchanged in the majority of patients studied.

TABLE V

MALNUTRITION

Total Number of Patients—26

	Increased	Decreased	Unchanged
Hemoglobin	14	9	3
Red Blood Cells	17	8	1
White Blood Cells	18	7	1
Polynuclears	11	12	3
Small Lymphocytes	17	8	1
Large Lymphocytes	14	7	5
Transitionals	3	10	13
Eosinophiles	5	8	13

Twenty-six infants and children received treatment for malnutrition. Of this number, there were fifteen females and eleven males, the youngest being a nine months infant, and the oldest child twelve years. The following were the results obtained:

Hemoglobin—Increased in fourteen patients (minimum increase 1%, maximum increase 22%); decreased in nine patients (minimum 1%, maximum 5%); unchanged in three patients (74%, 75%, 80% respectively).

Red Blood Cells—Increased in seventeen patients (minimum 20,000, maximum 1,300,000); decreased in eight patients (minimum 100,000, maximum 100,000); unchanged in one patient (3,800,000).

White Blood Cells—Increased in eighteen patients (minimum 100, maximum 7,250); decreased in seven patients (minimum 400, maximum 4,200); unchanged in one patient (10,000).

Polymorphonuclear Leukocytes — Increased in eleven patients, (minimum 4, maximum 20); decreased in twelve patients (minimum 2, maximum 24); unchanged in three patients (65, 64, 60 respectively).

Small Lymphocytes—Increased in seventeen (minimum 1, maximum 24); decreased in eight patients (minimum 1, maximum 38); unchanged in one patient (34).

Large Lymphocytes—Increased in fourteen patients (minimum 1, maximum 15); decreased in seven patients (minimum 2, maximum 8); unchanged in five patients (6, 4, 4, 0, 0, respectively).

Transitionals—Increased in three patients (minimum and maximum 1); decreased in ten patients (minimum 1, maximum 3); unchanged in thirteen patients (zero in all).

Eosinophiles—Increased in five patients (minimum 1, maximum 2); decreased in eight patients (minimum 1, maximum 4); unchanged in thirteen patients (2, 1, 0).

SUMMARY

The majority of patients with malnutrition, who received ultraviolet therapy, demonstrated an improvement in hemoglobin, red and white blood cells, small and large lymphocytes. The polynuclears were increased and decreased in about an equal number of patients, while the transitionals and eosinophiles were decreased in the majority of patients irradiated. It is interesting to note that the changes observed in the last two types of cells remained unaltered in an equal number of patients.

CONCLUSION

In general it might be stated that mercury vapor quartz light irradiations have a stimulating effect upon the blood picture in malnutrition. Incidentally most children after receiving exposures had better appetites; sleep was said to have improved (sedative influence of rays upon nervous system); their musculature became firmer; in short, the picture became transformed, from the so-called "tired child" to one of normalcy. That such an altered state is not unusual after ultraviolet therapy is common experience to physiotherapeutists.

TABLE VI

OTHER CONDITIONS

Total Number of Patients—6

	Increased	Decreased	Unchanged
Hemoglobin	3	3	0
Red Blood Cells	3	3	0
White Blood Cells	6	0	0

Polynuclears	4	2	0
Small Lymphocytes	4	2	0
Large Lymphocytes	4	2	0
Transitionals	1	1	4
Eosinophiles	0	2	4

Six patients, one with eczema on face, one with bronchiectasis, one with secondary anemia, one with nephrolithiasis, one with pylorospasm, and one with enterospasm received ultraviolet therapy. Of this number three were female children, two were males. There was one male infant aged nine months. The oldest children in this group were nine years (2) and all with the exception of the eczematous patient received generalized exposures.

Hemoglobin—Increased in three patients (minimum 8%, maximum 15%); decreased in three patients (minimum 3%, maximum 18%).

Red Blood Cells—Increased in three patients (minimum 440,000, maximum 580,000); decreased in three patients (minimum 110,000, maximum 1,300,000).

White Blood Cells—Increased in all six patients (minimum 1,500, maximum 5,500).

Polymorphonuclear Leukocytes — Increased in four patients (minimum 1, maximum 18); decreased in two (minimum 5, maximum 8).

Small Lymphocytes—Increased in four patients (minimum 4, maximum 22); decreased in two (minimum 1, maximum 17).

Large Lymphocytes—Increased in four patients (minimum 4, maximum 8); decreased in two patients (minimum 1, maximum 2).

Transitionals—Increased in one patient (1 cell); decreased in one patient (2 cells); unchanged in four patients (no cells were observed before or after irradiations).

Eosinophiles—Decreased in two patients (minimum 1, maximum 2); unchanged in four patients (no cells were observed before or after irradiations).

SUMMARY

The hemoglobin and red blood cells were increased as often as they were decreased. The white blood cells were increased in all six patients, the polynuclears, small and large lymphocytes were increased in four out of six patients, while the last three types of cells were decreased in two instances each.

The transitionals remained unchanged in four instances, increased in one patient and decreased in another patient.

The eosinophiles remained unchanged in four patients, while the blood examination in two patients indicated a decrease.

CONCLUSION

In the majority of patients treated there resulted an increase in white blood cells, polynuclears, small and large lymphocytes, an unchanged state in the transitionals and eosinophiles. Because of an equal number of patients who demonstrated an increase and decrease in the hemoglobin and red blood cells, the changes observed in the last two mentioned types of cells may be regarded as insignificant.

TABLE VIII

LESS THAN 5 MINUTE EXPOSURES

Number of Patients—21

	Increase	Decrease	Unchanged
Hemoglobin	42.8%	42.8%	14.2%
Red Blood Cells	57.1%	38. %	4.7%
White Blood Cells	66.6%	33.3%	.....
Polynuclears	61.9%	28.5%	9.5%
Small Lymphocytes	71.4%	28.5%	.....
Large Lymphocytes	57.1%	28.5%	14.2%
Transitionals	9.5%	23.8%	66.6%
Eosinophiles	14.2%	23.8%	61.9%

SUMMARY

The greatest increase occurred in the small lymphocytes (71.4%). In order of greatest percentage increase following the small lymphocytes were the white blood cells (66.6%), polynuclears (61.9%), red blood cells (57.1%). The transitionals and eosinophiles showed greater decreases than increases, about 23.8% each respectively. The hemoglobin was increased and decreased in about equal proportions (42.8%) and remained unchanged in 14.2% of patients.

PART II

EFFECT OF LENGTH OF EXPOSURES

	HB.			RBC			WBC			POLY			S. L.			L. L.			TRANS.			EOS.		
	I	D	U	I	D	U	I	D	U	I	D	U	I	D	U	I	D	U	I	D	U	I	D	U
Less than 5 Exposures	9	9	3	12	8	1	14	7	0	13	6	2	15	6	0	12	6	3	2	5	14	3	5	13
5-10 Exposures	9	5	0	7	7	0	9	5	0	10	4	0	10	4	0	9	4	1	2	5	7	1	6	7
10-15 Exposures	7	8	1	9	7	0	8	6	2	8	7	1	9	6	1	7	7	2	2	4	10	3	6	7
15-20 Exposures	3	0	0	2	1	0	3	0	0	0	2	1	2	1	0	1	1	1	1	0	2	1	0	2
20-30 Exposures	10	5	0	12	3	0	12	3	0	7	8	0	9	6	0	9	4	2	2	5	8	3	3	9
More than 30 Exposures	2	1	0	3	0	0	3	0	0	1	2	0	2	1	0	2	0	1	1	2	0	0	2	1
TOTALED																								
Laryng. Ste.	2	1		2	1		2	1		1	2			3		2	1				3	1	1	1
Eos. Ste.	1	2		2	1		2	1		1	2		2	1		1	2		2	1		1		2
Chr. Br.	17	9	1	19	8		17	9	1	17	9	1	19	8		14	9	4	5	8	14	3	9	15
Rickets	3	4		2	5		4	3		5	2		5	2		5	1	1	1		6	1	2	4
Malnutri.	14	9	3	17	8	1	18	7	1	11	12	3	17	8	1	14	7	5	3	10	13	5	8	13
Other	3	3		3	3		6			4	2		4	2		4	2		1	1	4		2	4
TOTAL	40	28	4	45	26	1	49	21	2	39	29	4	47	24	1	40	22	10	12	20	40	11	22	39

I—Increased
D—Decreased
U—Unchanged

CONCLUSION

Hemoglobin was not materially benefited. Red blood cells, white blood cells, polynuclears and small and large lymphocytes were definitely increased, while transitionals and eosinophiles remained unchanged in the majority of patients. The last mentioned group of cells were more often decreased than increased.

TABLE IX

5-10 MINUTE EXPOSURES
Number of Patients—14

	In-crease	De-crease	Un-changed
Hemoglobin	64.2%	35.7%	.....
Red Blood Cells	50. %	50. %	.....
White Blood Cells	64.2%	35.7%	.....
Polynuclers	71.4%	28.5%	.....
Small Lymphocytes	71.4%	28.5%	.....
Large Lymphocytes	64.2%	28.5%	7.1%
Transitionals	14.2%	35.7%	50. %
Eosinophiles	7.1%	42.8%	50. %

SUMMARY

Greatest increase in order of frequency were polynuclears and small lymphocytes, 71.4% each, followed by hemoglobin, white blood cells and large lymphocytes 64.2% each respectively. Transitionals and eosinophiles remained unchanged in 50% patients and in the remaining half of individuals were decreased with far greater frequency than they were increased. Red blood cells were decreased as frequently as they were increased.

CONCLUSION

Hemoglobin was definitely increased by the ten minute exposures as were also the white blood cells, polynuclears, small lymphocytes and large lymphocytes. The transitionals and eosinophiles remained unchanged in the one-half group of patients and were decreased more often than increased in the remaining number of patients.

TABLE X

10-15 MINUTE EXPOSURES

Number of Patients—16

	Increase	Decrease	Unchanged
Hemoglobin	43.7%	50. %	6.2%
Red Blood Cells	56.2%	43.7%	.....
White Blood Cells	50. %	37.5%	12.5%
Polynuclears	50. %	43.7%	6.2%
Small Lymphocytes	56.2%	37.5%	6.2%
Large Lymphocytes	43.7%	43.7%	12.5%
Transitionals	12.5%	25. %	62.5%
Eosinophiles	18.7%	37.5%	43.7%

SUMMARY

Hemoglobin decreased in 50% of patients. The greatest increases occurred in the following groups of cells—red blood cells 56.2%, small lymphocytes 56.2%, white blood cells 50%, polynuclears 50%, large lymphocytes were increased as often as they were decreased 43.7%, and unchanged in 12.5% of cases. Transitionals and eosinophiles remained unchanged in larger proportion of patients while they were decreased more often than increased.

CONCLUSION

The cells stimulated by ten to fifteen minute exposures included the red blood cells, white blood cells, polynuclears and small lymphocytes. The cells depressed or unchanged from irradiations in this group were the transitionals and eosinophiles. Hemoglobin was depressed.

TABLE XI

15-20 MINUTE EXPOSURES

Number of Patients—3

	Increase	Decrease	Unchanged
Hemoglobin	100. %	.....	.....
Red Blood Cells	66.6%	33.3%	.....
White Blood Cells	100. %	.....	.....
Polynuclears	.....	66.6%	33.3%
Small Lymphocytes	66.6%	33.3%	.....
Large Lymphocytes	33.3%	33.3%	33.3%
Transitionals	33.3%	.....	66.6%
Eosinophiles	33.3%	.....	66.6%

SUMMARY

Hemoglobin increased in all three patients as were also the white blood cells. Red blood cells and small lymphocytes were increased in 66.6%. Polynuclears were decreased in 66.6%. Large lymphocytes remained unchanged in 33.3%, decreased and increased in an equal number of patients, 33.3%. Transitionals and eosinophiles remained unchanged in majority of patients.

CONCLUSION

It is realized that small number of patients studied in this group of patients prevents definite conclusions to be drawn. The hemoglobin, red blood cells, white blood cells and small lymphocytes were increased while a decrease followed fifteen to twenty minute exposure of the polynuclears.

TABLE XII

20-30 MINUTE EXPOSURES

Number of Patients—15

	Increase	Decrease	Unchanged
Hemoglobin	66.6%	33.3%	.....
Red Blood Cells	80. %	20. %	.....
White Blood Cells	80. %	20. %	.....
Polynuclears	46.6%	53.3%	.....
Small Lymphocytes	60. %	40. %	.....
Large Lymphocytes	60. %	26.6%	13.3%
Transitionals	13.3%	33.3%	53.3%
Eosinophiles	20. %	20. %	60. %

SUMMARY

Greatest increase in order of frequency: red blood cells, and white blood cells 80%, each; hemoglobin 66.6%, small lymphocytes and large lymphocytes 60%, each. Greatest decrease in order of frequency: polynuclears 53.3%. Transitionals and eosinophiles unchanged more frequently 53.3% and 60% respectively. The transitionals were decreased more often than increased, while the eosinophiles were increased as often as they were decreased.

CONCLUSIONS

The blood constituents benefited by twenty to thirty minute exposures were the hemoglobin,

red and white blood cells, small and large lymphocytes. The cells unchanged were the transitionals and eosinophiles. The polynuclears were depressed.

TABLE XIII

MORE THAN 30 MINUTE EXPOSURES

Number of Patients—3

	Increase	Decrease	Unchanged
Hemoglobin	66.6%	33.3%	.....
Red Blood Cells	100. %	.....	.....
White Blood Cells	100. %	.....	.....
Polynuclears	33.3%	66.6%	.....
Small Lymphocytes	66.6%	33.3%	.....
Large Lymphocytes	66.6%	.....	33.3%
Transitionals	33.3%	66.6%	.....
Eosinophiles	66.6%	33.3%	.....

SUMMARY

Red blood cells and white blood cells were increased in 100%. Hemoglobin was increased in 66.6% as were also the small lymphocytes, large lymphocytes and eosinophiles. The transitionals and polynuclears were decreased in 66.6% individuals each.

CONCLUSIONS

The three patients who received more than thirty minute exposures demonstrated an increase in the hemoglobin, red and white blood cells, small and large lymphocytes and eosinophiles. Depression occurred only in the polynuclears and transitional cells.

Considering all conditions for which treatments were administered in a series of 72 patients, 21 individuals received less than five minute exposures; 14 from five to 10 minute exposures; 16 from 10 to 15 minute irradiations; three from 15 to 20 minute exposures; 15 from 20 to 30 minute exposures; and three more than 30 minute exposures.

It will be seen that the majority of patients received less than five minute irradiations. This was followed by the group who received 10-15 minute exposures. The third group 20-30 minute exposures; fourth 5 to 10 minute exposures; and the minimum number of patients were those in the 15-20 minute group and those who received more than 30 minutes.

Hemoglobin—Forty patients demonstrated a definite increase in the hemoglobin, 28 a decrease, while in four patients this element remained unchanged.

Considered as a whole, the 40 patients showed a definite increase in the hemoglobin, 28 a decrease and four were unchanged.

Red Blood Cells—Increased in 45 patients, decreased in 26, unchanged in one.

White Blood Cells—Increased in 49; decreased in 21; unchanged in two.

Polymorphonuclears—Increased in 39; decreased in 29; unchanged in four.

Small Lymphocytes—Increased in 47; decreased in 24; unchanged in one.

Large Lymphocytes—Increased in 40; decreased in 22; unchanged in 10.

Transitionals—Increased in 12; decreased in 20; unchanged in forty.

Eosinophiles—Increased in 11; decreased in 22; unchanged in 39.

CONCLUSIONS

1. Generalized exposures from a mercury vapor quartz light air-cooled lamp is of definite value in treatment of secondary anemia which occurs during the course of or caused by malnutrition, chronic bronchitis, infantile rickets, esophageal stenosis, laryngeal stenosis, eczema, bronchiectasis, intestinal parasites, nephrolithiasis, pylorospasm and enterospasm.

2. In the series of patients studied the hemoglobin, red blood cells, white blood cells, polynuclears, small and large lymphocytes were increased in numbers. The transitionals and eosinophile cells remained unaffected (unchanged), in most patients.

3. Contrary to recent investigations of artificial heliotherapy upon the vascular system, generalized exposures using the technic outlined in this paper for periods of thirty minutes does not appear to materially depress the various blood cellular elements, but stimulates their numbers. The last mentioned statement also holds true in regard to the hemoglobin.

4. The simple technic and ease of administering artificial heliotherapy to the young renders the comparatively newer method a distinct therapeutic advance of treating patients, the subjects of secondary anemia.

5. The physiotherapeutic procedure possesses many advantages over drug therapy, which is often difficult to administer to infants and children.

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RADIOSENSITIVITY OF TUMORS*

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The study of tumor radiosensitivity is not new. More than fifteen years ago it was recognized that different types of tumors reacted differently to the same amount of radiation. As early as 1915 James Ewing had classified tumors in the order of their relative radiosensitivity. Since that time the studies have been continued and the classification is much more comprehensive than was at first anticipated.

Original Classification

Ewing's original classification of tumors in the order of their sensitivity is as follows:

1. Lymphoma.
2. Embryonal tumors.
3. Cellular anaplastic tumors.
4. Basal cell carcinoma.
5. Adenoma and adenocarcinoma.
6. Desmoplastic tumors (squamous carcinoma and fibrocarcinoma).
7. Fibroplastic sarcoma; osteosarcoma; neurosarcoma.

The order of this classification has not been changed by any recent investigation. It has simply been enlarged upon. Not only has the whole group been arranged in the order of susceptibility, but the various neoplasms involved in the pathology of individual organs, or groups of organs, have been arranged in the order of their sensitivity. The arrangement of the types of neoplasms is, as a whole, applicable to any individual organ, for example the breast.

Many things enter into the factors controlling radiosentitivity. Some are quite obscure. We do not always see the same type of tumor respond with the same degree of certainty in every individual, and we hesitate to predict the outcome of radiation on even the most susceptible of tumors in some patients. This is due to the various clinical factors which may enter into and influence the turn of the tide for better or for worse.

The vascularity of the tumor, the rapidity of its growth, the metabolism of the cell, the gen-

*Read at the Eighth Annual Meeting of the American Congress of Physical Therapy, Chicago, Nov. 4, 1929.

eral condition of the patient, the occurrence of intercurrent disease and the efficiency of the digestive, renal and cardiac systems all enter into the problem and make the establishment of certain definite clinical results impossible.

The interesting part of the study of tumor radiosensitivity is the resistance encountered in some of the sensitive tumors and the ease with which, at times, others of the resistant tumors react to radiation therapy. Some other factors than merely the radiation itself or the degree of radiosensitivity contribute to the result. We are acquainted with the nature of some of these factors but others of them still elude the most painstaking research.

A fairly constant relation exists between tumor structure and its susceptibility to radiation. As a rule, tumors composed of rapidly multiplying cells are the most radiosensitive and this radiosensitivity is almost in direct proportion to the rapidity of their growth. This is most markedly noticeable in tumors of the lymphoid group and those composed of embryonal cells. The loose structure of the cell, the delicate blood supply, the paucity of fibrous structure and the absence of a definite plan of growth possibly account for their susceptibility to radiation. Metastases do not occur readily and the beneficial effects of treatment probably occur before metastases are produced.

The resistance of the adenoma and the scirrhus carcinoma to radiation is explained by the definite way in which the cells grow, the production of fibrous tissue, the blood supply, the frequent presence of mucus and the fact that the cell is an adult type of cell of compact structure and low metabolism. Of all these factors which enter into the radioresistance of tumors perhaps the most important is the tendency to produce fibrous tissue. This tendency explains the particular resistance to treatment displayed by some types of sarcoma. Almost all the variations of cellular construction in the differentiation of tumors lie between the lymphoid group on the one hand and the scirrhus carcinoma on the other.

There is another group of tumors of special cellular construction. The more highly differentiated the cell the greater is its resistance to radiation. As has been stated, the lymphoid cell is very sensitive and it has, practically speaking, no cell structure, while the rods and cones of the retina, which are highly specialized, are said to be exceedingly radioresistant. In this group of tumors of highly specialized cellular structure are the fibrosarcoma, the neurosarcoma, the osteosarcoma and the squamouscarcinoma.

There are two exceptions to the general rules that have just been reviewed. The melenoma is a tumor of cellular structure but it is quite resistant. The giant cell tumor, though benign, is highly sensitive.

Classification of Tumors by Organs

Since 1915, there have been made some excellent classifications of tumor radiosensitivity from the standpoint of the viscus in which the tumor originated. Such classifications are an aid not only to the surgeon referring the case for therapy but to the therapist.

Carcinomas of the breast present one of the most interesting groups. Adair's classification is as follows:

A Duct carcinoma
1. Scirrhus, radiosresistant
2. Medullary, slightly radiosensitive, heavy radiation required
3. Diffuse, tumor slightly radiosensitive, metastases sensitive
4. Paget's radiosensitive
5. Inflammatory, very radiosensitive
6. Anaplastic, very radiosensitive, but results bad on account of bone metastases.

B Adenocarcinoma
1. Cystadenocarcinoma, slow metastases, radioresistant
2. Bulky adenocarcinoma, radioresistant
3. Sweat gland, radioresistant
4. Gelatinous, sensitive to heavy radiation
5. Anaplastic, radiosensitive.

A glance at this group of tumors shows that the majority are radioresistant to a greater or less degree. This observation demonstrates that the institution of radiation therapy to breast

tumors must be prompt and the maximum amount of radiation must be administered. There have been some recent articles on the irradiation of breast tumors that apparently discount the beneficial effects that may be expected from irradiation and tend to discourage this form of treatment. Such conclusions as these articles present can be drawn only from statistics gathered from improperly or inadequately irradiated cases.

In 1923, Dr. Max Cutler classified carcinomas of the cervix according to their radiosensitivity as follows:

I. Adult cell type, radioresistant
II. Plexiform cell type, radiosensitive
III. Anaplastic cell type, very radiosensitive

Herendeen's classification of the bone tumors in the order of their radiosensitivity is as follows:

1. Endothelial myeloma (Ewings tumor), radiosensitive
2. Giant cell tumor, radiosensitive
3. Multiple myeloma, radiosensitive
4. Osteogenic sarcoma, destructive type, somewhat radiosensitive
5. Osteogenic sarcoma, mixed type, somewhat radioresistant
6. Osteogenic sarcoma, sclerosing type, radioresistant

Allen, in an article on the diagnosis of tumors of the orbit from their susceptibility to radiation, classifies them as follows:

Radioresistant
- Cysts
- Polypi
- Inflammatory masses
- Teratoma
- Lipoma

Slowly radiosensitive
- Lymphangioma
- Cavernous angioma
- Metastatic thyroid
- Endothelioma
- Myxoma
- Perithelioma (sarcomatous type)
- Sarcoma (soft tissue)
- Glioma
- Neurofibroma
- Chondrosarcoma

Very radiosensitive
- Lymphosarcoma
- Carcinoma of lacrimal gland
- Metastatic carcinoma (embryonal)

We disagree with the classification of polypi and inflammatory masses. Our experience has led us to feel that polypi are sensitive to heavy radiation with radium, that inflammatory masses are quite radiosensitive, so that properly these two tumors should be placed in the second division, that of tumors slowly radiosensitive.

Newgrowths of the digestive tract do not show the wide variety of types that are present in some of the other organs. The squamous cell epithelioma occurs most frequently in the esophagus and rectum, while the adenocarcinoma attacks any portion of the digestive tract and is the most common cancer of the stomach and bowels. The squamous cell type has all the characteristics of the skin cancer and is very radioresistant. The adenocarcinoma is resistant to irradiation and is especially so if it undergoes fibrous degeneration, as so frequently happens. The metastases from these tumors are also radioresistant but are more susceptible than the primary tumors. Fibromas, lipomas, myomas, and round and spindle cell sarcomas occur so rarely in the digestive tract that their radiosensitivity from actual clinical experience has not been well established. It is, perhaps, safe to predict that they will assume the same order that they take in other parts of the body.

Neoplasms of the urinary bladder are most frequently pappillomatous in type. They are the mucous variety and occur as simple pappillomas or they may be multiple or even villous. They are quite radiosensitive and some of our most pleasing results have come from the treatment of these patients with radiation after the mass of the tumor has been removed by the high frequency current. Recurrences and metastases of pappillomas, though rare, are readily susceptible to radiation. Adenocarcinoma and scirrhus tumors are very rarely found in the bladder but when they do occur they are usually extensions from tumors of the prostate.

The hypernephroma and the papilloma are the most common kidney tumors, the former arising from the suprarenal gland and usually involving the upper pole of the kidney, the latter rising from the kidney pelvis and encroaching upon the hilum. Both are somewhat radiosensitive. Surgical removal of the kidney is usually done and the patient referred for radiation. The metastases are radiosensitive and much more than mere palliation may be accomplished by heavy radiation. Sarcomas of the kidney occur at all ages and are usually round or spindle cell in type. They are extremely radioresistant. Adenomas may arise from either the kidney tissue proper or from the suprarenal remnants or "rests." These, also, are radioresistant although the metastases, which are not uncommon, are radiosensitive to heavy radiation.

Cancers comprise about 13% of the pathological conditions found in the prostate. They are almost always adenomas and, although somewhat radioresistant, yield quite well to the combination of radium and roentgen therapy. Such therapy, by means of implants of radium or radon combined with cross firing by roentgen ray, produces a high percentage of radiation in the tumorous gland. From a clinical standpoint, irradiation of these tumors is very satisfactory. While the tumors tend to metastatisize early, especially into the bones of the pelvis, the metastatic areas are radiosensitive.

In order to enable the radiologist to benefit more adequately the patient who has carcinoma or sarcoma it is necessary that cooperation exist between surgeon, pathologist and radiologist. Such cooperation can be obtained by calling attention again and again to the benefits that the patient receives when cooperation is secured. It is not sufficient that the tumor be removed surgically and then the patient be allowed to go on to death with the feeling that medical science has accomplished all it can. Surgical removal is but one step and the first step only in the treatment of the cancerous patient.

In like manner, the pathologist should not be content to report only the tissue at hand. He should have in mind the radiosensitivity of the tumor, its tendency to metastisize and its degree of malignancy when making his report to the radiologist and surgeon.

Only by such cooperation can we hope to achieve the goal that is expected of us by those people who are our patients.

CONCLUSIONS

1. Many years of study will be required before the classifications of tumors according to their radiosensitivity will be complete. The study will be influenced by more accurate microscopic diagnosis and continued improvement in radiation therapy.

2. No one should undertake the treatment of any tumor by irradiation without first knowing, if it is possible, the type of tumor he is about to treat, the tissue of origin, the degree of malignancy it displays, and its susceptibility to radiation.

3. If biopsy is not available, a fairly accurate determination of the type of tumor under treatment may be made by its response to irradiation, by noting whether or not it produces metastases, and, if so, by the location, extent, and degree of radiosensitivity of such metastases.

4. A study of the radiosensitivity of tumors enables us to give a more accurate prognosis of radiation therapy and to gauge better the amount of radiation required in any given case.

5. The progress of medicine in radiation therapy will be augmented when the conscientious radiologist attacks the tumor problem from the standpoint of its malignancy and radiosensitivity.

6. The highest type of cooperation must exist between the surgeon, pathologist and radiologist.

PRELIMINARY OBSERVATIONS AS TO PENETRATION OF RADIANT ENERGY*

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Radiation energy is defined by Turrell[1] as the force transmitted by the ether in the form of waves resulting from periodic vibration or rotation of electrons. It is most difficult to interpret because of its complex nature. "Radiation," says Bovie,[2] "is part of our environment. It is one of the guiding forces of evolution. Radiation is not heat in the ordinary sense but is energy in that form which we call radiant energy or radiation."

Radiation on absorption may be transformed into heat and into chemical energy. Only that energy which is absorbed can have effect (Von Grotthus); to produce absorption we must have penetration. The type of radiation used for its heating value is that from a heated resistor, or that from an incandescent lamp. These are usually designated as infra-red generators, deep therapy lamps, etc.

Infra-red radiations are emitted by any hot body. The temperature to which the radiator is heated determines the wave length at which energy is most intense. Therefore, any hot body is an infra-red generator.

Radiations from some of these lamps or special filaments are claimed to "peak" in the long infra-red at 30,000 A°, according to Wiens' displacement law, which assumes that radiation follows black body law. It follows therefore as the temperature is increased, wave length at which radiant heat is emitted becomes less.

We often speak of heat and temperature as synonymous terms; they are different. Heat is energy, temperature is a relative condition. Temperature is the hotness of the body as compared with another body. Temperature is in direct relation to the hotness of the body. For instance, given two one-quart hot water bottles, one filled with kerosene at 100° C., another filled with water at 100° C. Which possesses the greater amount of heat energy? Since the specific heat of kerosene is one half of water only one-half as much heat-energy is required to raise one quart of kerosene to 100° C. as is required to raise one quart of water to 100° C. Therefore, hot water bag filled with water has twice as much heat energy available for use.

In order to establish to my satisfaction whether infra-red radiation has real power of penetration and, if so, how much, and from which source it could be obtained most advantageously, I sought the aid of R. C. Burt, E.E. Ph.D. Research, Fellow of the California Institute of Technology and head of the R. C. Burt Scientific Laboratories of Pasadena, California. I employed Dr. Burt in the capacity of consultant to determine what form of infra-red generator or tungsten filament lamp produced the largest amount of rays which could penetrate the human body.

Because of experimental difficulties in using living tissue, we decided for preliminary experiments to use water, and glass, for filters in examining the radiation emitted. The experiment was conducted in the Physical Therapy Department of the Pasadena Hospital.

The detailed experiment of Dr. Burt is given as follows:

"From Edison Pettit (Astrophysical Journal, Vol. LXVI, 1927, pp. 43-58)[3] we know that:

"Water is 50% transparent from 2000A° to 11,000A°, and falls off to 10% at 13,500A°, and to less 1% from 14,000 to 200,000.

*Read before the Pacific Physiotherapy Association Convention, Los Angeles, California, June 22, 1929.

"Glass 0.5 mm. thick transmits 50% or more between 3,000A°, and 40,000A°, and beyond it transmits almost nothing even in such layers. Heavy plate glass transmits from 3,500A° to 25,500A° and nothing longer.

"We know that 1 cm. water transmits visible and infra-red to 13,500A° and nothing longer, and 1 cm. glass transmits visible and infra-red to 25,000A° and nothing beyond.

"I placed a calibrated thermopile eleven inches below an infra-red 250 watt generator in a reflector, and measured the energy received through 6 mm. of glass to be .152 absolute units; through 13 mm. of glass to be .108 absolute units; through 2 mm. of glass and 2 mm. of water less than .001 absolute units.

"I placed the same thermopile junction 40 inches from a deep therapy lamp (1500 watt Mazda lamp, in a reflector) and measured the energy received through 13 mm. glass, 3 mm. water and 2 mm. glass and found it to be .207 absolute units.

"From this it is evident that infra-red generator delivers considerable infra-red (at 11 inches) which will pass through glass, but less than 1/1000th of a unit of infra-red which will penetrate 2 mm. of water. The deep therapy lamp at forty inches delivers .207 absolute units which will penetrate water.

"As I stated at the time the test was conducted:

"Light (visible and infra-red) either penetrates the body, or it does not. If it does not penetrate, then it is surface heat which could be supplied by a hot water bottle, or an electric pad with equal efficacy. If it does penetrate, then the generator which produces the largest amount of penetrating infra-red is desired.

"I postulate that an infra-red or visible light which will not penetrate water will not penetrate the body. But the converse is not necessarily true, that is: Because a ray will penetrate water is no reason *a priori* why it necessarily will penetrate the body. In other words, infra-red generator delivers less than 1/1000 units which could possibly penetrate the body, while the deep therapy lamp delivers .207 units which can penetrate through water and hence some of them might penetrate the body.

"I conclude that the infra-red generator used in this test has no infra-red which will penetrate the body, and that the deep therapy lamp has considerable radiation which will pass through water, and hence might penetrate the body.

"I might further note practically 80% of the rays in sunlight will pass through water because those longer than 13,500 have been absorbed by the water vapor in the atmosphere. The intensity of solar radiation at the surface of the earth is about 1.6 absolute units."

These findings coincide with my clinical observations in my private practice and in the Physical Therapy Department of the Pasadena Hospital, namely, that I thought I obtained much better therapeutic results when I used radiation from a 1500 watt tungsten filament lamp than from an infra-red generator using various types of high resistance filaments.

Other evidence exists which supports my belief that luminous infra-red radiation from incandescent light has greater therapeutic possibilities than infra-red from infra-red generators. Granger says:[4]

"Luminous rays, plus their associated infra-red, seem to have deeper power of penetration than the infra-red alone."

Turrell[1] states that:

"In clinical practice I detect little or no difference between the effects of radiant heat administered by light baths and the effects of convective heat of the hot air bath, or conductive application of other substances to the skin. The convenience of the electric light as a method of application is all that commends it above other methods. It is doubtful if any other form of heat except from high frequency currents, penetrates actively vascular tissue to the same depth as radiant light."

In a most excellent report by Sonne[5] we read:

"I have with a series of different persons found that with only small individual variations, they can bear much more heat calories radiated on to the skin with luminous rays than with inner and outer infra-red rays. This may be seen by the average figure 3.11 calories by luminous rays as against 1.33

calories by outer infra-red rays and 1.79 calories by inner infra-red; thus more than twice as much luminous heat can be borne as ordinary invisible heat radiation."

After taking into account reflection, the same author says:

"The quantity of calories which can be absorbed by the skin during an irradiation with visible rays, without being burned is about twice as great as that which we can absorb by irradiation with invisible heat rays."

And again:

"We can absorb twice as much irradiation by visible rays as by invisible rays, but nevertheless the temperature of the surface of the skin is considerably higher with the latter irradiation than with the former. This can only mean that the invisible heat rays are absorbed immediately on the surface of the skin and have very quickly heated the same to a temperature which is so high that we can hardly bear it, and therefore a further irradiation is prevented. The visible heat rays, on the contrary, pass to an essential degree through the surface; they do not heat the same so violently and a far greater heat irradiation can therefore be borne in this manner. But the tissue beneath the skin is, on the other hand, much more heated by the visible rays. This is seen by the fact that the temperature of the skin, after discontinuation of the irradiation, is higher with irradiation by invisible rays. In the former case the heat from the deeper layers is transmitted to the surface of the skin while, in the latter case, the heat is quickly transferred from the surface of the skin to the surrounding air after the irradiation. More heat penetrates the subcutaneous tissue during an irradiation with visible rays than during an irradiation with invisible rays."

Elsewhere in the same paper Sonne says:

"It is the blood carrying stratum in and beneath the skin which, by irradiation with luminous rays attains this high temperature (47.7 degrees). In a corresponding depth we have, by irradiating with an invisible heat ray, a temperature of barely 42 degrees. By irradiation we have thus been able to heat the blood beneath the irradiated spot to about 48 degrees or five degrees higher than we can heat it with ordinary heat rays. You again see here, of what enormous difference it is whether the organism is irradiated, with luminous heat rays or with invisible heat rays."

I must not quote the entire article; it is so splendid one is tempted, but I can only recommend that everyone interested in the problem read this article by Dr. Sonne with very great care.

One of the pitfalls of research is that we are apt to forget variables. I realize in our test the variables were:

1. Use of 250 watt infra-red generator at 11 in. as compared to 1500 watt tungsten filament lamp at 40 in.

2. That water and glass were used instead of living tissue.

But a doctor judges the efficiency of any therapeutic measure by the results he gets. Likewise, the patient judges the doctor by the therapeutic results *he* gets, and neither patient nor doctor pays much attention to variables.

CONCLUSIONS

From my observations, substantiated by many other workers, it appears that the incandescent tungsten filament lamp as a source of radiant energy is superior to the present high resistor infra-red generator as a therapeutic adjunct.

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PHYSICAL THERAPY CLINICS

X-RAY AND RADIUM THERAPY CLINIC*

A. F. TYLER, B.Sc., M.D.

OMAHA

We are pleased to present to you this morning six cases, each one representing a particular type of its class.

The first one is a keloid which arose in the scar resulting from removal of a small papilloma in the right parotid region. This case is of interest because repeated x-ray treatments failed to cause the keloid to disappear. It has been our experience, in the majority of cases, keloids will disappear slowly under repeated small doses of x-ray. In this case, however, there seemed to be no appreciable effect even though the treatments were carried over a period of several months. On the other hand a single treatment with unfiltered radium resulted in complete disappearance.

The second case is that of epitheliomas situated on the nose which were cleared up by x-ray treatments even though the epitheliomas had recurred following removal by chemical caustic.

The first two cases illustrate the application of low voltage lightly filtered x-rays to the skin. The third, fourth and fifth cases represent types suitable for high voltage x-ray treatment. The sixth represents a case in which a combination of high voltage x-ray and radium is most suitable.

KELOID IN THE SCAR RESULTING FROM REMOVAL OF A SMALL PAPILLOMA IN THE RIGHT PAROTID REGION

Case No. 29805. Mrs. H. E. K. This patient presented herself on September 15th, 1927, for the removal of a small papilloma measuring about 5 mm. in diameter in the right parotid region. Under novocaine anesthesia, this was destroyed with the monopolar high frequency current. An uneventful recovery was made.

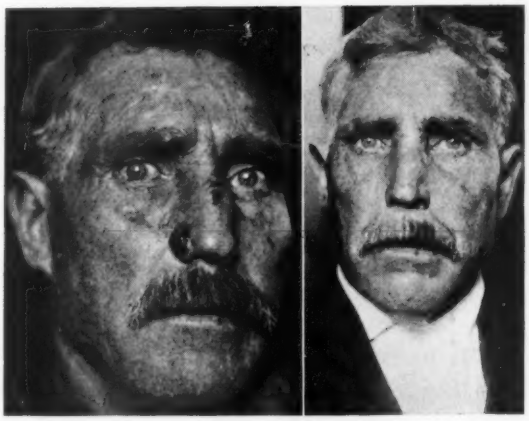
On February 8th, 1928, she returned because of an elevation in the scar, which was found to be a small keloid, measuring about 5 mm. by 2 mm. in size.

This was treated six times during February and March, 1928, with low voltage x-ray using 85 K.V.P. with 1 mm. of aluminum and leather as filter, 10 inch distance, 5 ma. of current and 5 minutes each treatment. The same treatment was applied three times in April, once in May, once in June, once in July and once in September of 1928, with only slight recession. On October 1st, 1928, 25 mg. hours of unfiltered radium was applied to the keloid in the form of hollow needles. This produced quite an erythema but the keloid quickly receded and has not returned.

MULTIPLE EPITHELIOMAS OF THE NOSE

Case No. 7627. Mr. T. P. 53 years of age, married. Five years ago the patient noticed a rough scaly place on the left side of the nose with another on the right side near the nostril. These gradually grew in size and finally became ulcerated. He then consulted some one who destroyed the growths with caustic paste which caused the ulcers to heal, and they remained well about four years, at which time there was a return of the growth accompanied by several new growths on the nose.

*Read at the eighth annual meeting, American Congress of Physical Therapy, Chicago, Nov. 7, 1929.



Case No. 7627

At the time he came for examination, February 11th, 1918, the right ala nasi was occupied by a cauliflower growth measuring 2 cm. in diameter and elevated above the skin .5 cm. There were multiple flat indurated ulcerated areas on both sides of the bridge of the nose. X-ray treatments were given through the months of February, March, June and September of 1918 using 85 K.V.P. 1 mm. of aluminum and leather, 10 inch distance, 5 ma. current, 5 minutes each treatment. The epitheliomas disappeared and have remained well up to the present time.

UTERINE FIBROIDS

Case No. 33685. Mrs. J. E. L. Age 43. The patient is a white female presenting herself because of excessive menstrual flow lasting ten days to two weeks covering a period of the past six months. Physical examination was negative except the pelvic examination which shows several nodular enlargements on the body of the uterus from 1 to 5 cm. in diameter.

High voltage x-ray treatment was given through the pelvis using the equivalent of 220,000 peak volts with .75 mm. of copper and 1 mm. of aluminum filter, 50 cm. distance with the skin dosage 118% and the uterine dose 96%.

The patient had one menstrual period following the treatment which was just as profuse as previous to the treatment. Since then there has been no menstruation.

Examination made four months after the treatment was given, shows the patient has gained weight, feels well and the uterus is normal in size and smooth in contour.

SPLENOMYELOGENOUS LEUKEMIA

Case No. 17395. Mr. T. A. F. Age 51. This patient presented himself for examination on January 19th, 1922, complaining of weakness and a tumor in the left side of the abdomen.

The patient is an emaciated white adult, male, who enters the hospital complaining of weakness of the legs and mass in the left side of the abdomen of three months duration. He also complains of frequency of urination, both nocturnal and diurnal. He was in the hospital during 1918 and 1919—on both occasions with similar complaints. On each visit he received x-ray therapy for a mass in the left upper abdomen and on both occasions felt very much relieved, so much so in fact that he has been able to go about his duties unhampered as telegraph operator until three months ago.

In the past three months the mass in the abdomen has gradually increased in size. There is no pain but he complains of a feeling of pressure. He has lost eight pounds in weight during the past three months.

Physical examination showed many careous teeth and spleen enlarged extending to the right of the midline and about four fingers breadth below the umbilicus. Blood examination on the first observation, 1918, showed 288,000 white cells. The differential count is not available. January 20th, 1922, it was as follows:

Hemoglobin	75-80%
Red Cells	2,700,000
White Cells	80,000
Polynuclear Neutrophiles	25%
Eosinophiles	2%
Small Lymphocytes	5%
Transitional	8%
Myelocytes	60%
	100%

On February 28th as follows:

Hemoglobin	85%
Red Count	4,550,000
White Count	10,800

Differential count cells	100
Polys	87%
Small Lymphos	11%
Large Lymphos	1
Basophils	1
Myelocytes—	
Basophiles	15%
Neutrophiles	34%
Eosinophiles	11%

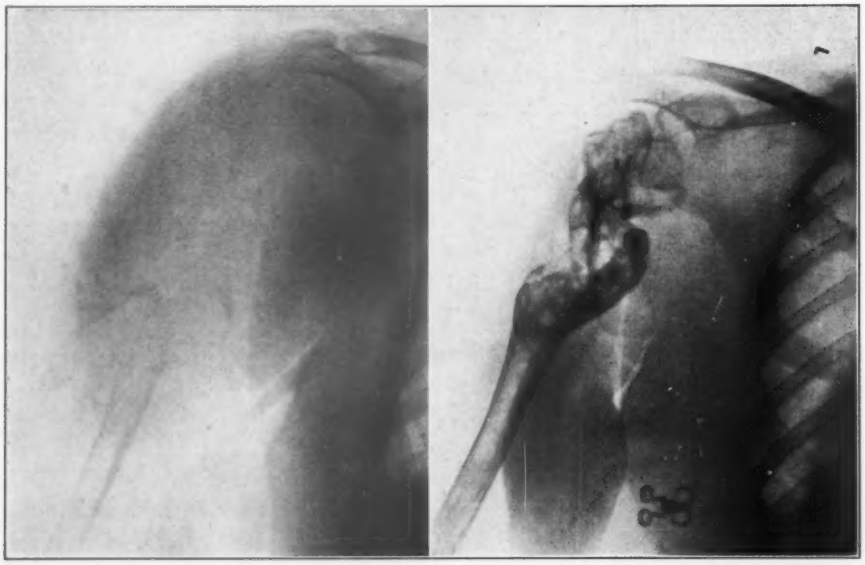
Treatment was given with the high voltage x-ray through the spleen posterior and anterior, using 200,000 K.V.P., 1 mm. copper and 1 mm. aluminum as filter in such a manner that the depth dose was 80%. Blood count after the treatment showed as indicated above and the spleen decreased rapidly in size until at the time of the above blood count it was barely palpable below the left costal margin. This patient continued about his work until March, 1923, at which time he became weak and exhausted and had to take to his bed. He was deceased July 17th, 1923.

OSTEOGENIC SARCOMA

Case No. 29856. S. F. The patient is a white female, high school student, seventeen years of age, who says that about nine months previously, while walking up the steps, she slipped and fell forward striking the upper part of the left arm against the edge of a stone step. Following this injury she consulted a physician because of the pain from the bruise. This subsided under medical care within a short time. In spite of the fact, however, that there was no external evidence of any further trouble, she continued to have discomfort which later became real pain. As the pain reappeared the upper arm began to slowly enlarge without discoloration.

At the time of our examination on September 23rd, 1927, the upper half of the left arm was enlarged to about twice the normal size. The skin was of normal color but the swelling had a boggy feeling on palpation. X-ray examination made at that time showed complete destruction of the upper half of the left humerus. This portion of the bone was occupied by a soft tissue mass in which were a few areas of bone deposit. X-ray examination of the chest failed to show any evidence of new growth in the lungs, pleura, or ribs. Diagnosis at that time was osteogenic sarcoma.

Previous to our observation, an incision had been made over the anterior surface of the mass and 100 mg. of radium in a capsule, the walls of which were 1.5 mm. thick, forced into the central portion of the tumor and allowed to remain twenty-four hours. In addition to this, we



Case No. 29856

Fig. 1—Osteogenic Sarcoma before radiation treatment (September 23, 1927.)

Fig. 2—Same case after radiation treatment (November 23, 1928.)

applied high voltage x-ray treatment through the mass anteroposteriorly and posteroanteriorly. Much to our pleasure and surprise, there was a rapid decrease in the size of the mass which continued until the arm became normal size.

The patient is still under observation. X-ray film made November 23rd, 1928, shows the humerus is gradually regenerating and is even making an attempt to form a new head. The young woman is in good health and is able to continue her school work. She has considerable movement in the shoulder joint, but is unable to abduct the arm from the body more than 45 degrees.

CARCINOMA OF THE VAGINAL VAULT AND PARAMETRIA RECURRENT AFTER CAUTERIZATION OF CARCINOMA OF THE CERVIX

Case No. 15460. Mrs. A. F. S. This patient 47 years of age came complaining of bleeding from the vagina. She had had the cervix of the uterus cauterized six months prior to seeing us for what was diagnosed carcinoma.

Physical examination showed a bleeding mass occupying the vaginal vault and so-called frozen pelvis.

She was treated with high voltage x-ray and the bleeding soon stopped and the induration in the pelvis disappeared. She remained well until February, 1921, when she returned complaining of a slightly blood-tinged discharge. Examination showed a small recurrence on the anterior vaginal wall.

This was treated with radium packed in the vaginal canal directly against the growth in the vaginal wall. Following this treatment she was under close observation for seven years and remained well—death occurring from intercurrent disease.

DISCUSSION

In the use of x-ray and radium in the treatment of disease, it is well for us to review for a moment the action of these agents on the tissues. Beginning immediately after the treatment has been applied but not demonstrable under the microscope until from a few hours to a few days, an edema of the endothelial lining of the capillaries takes place. In very vascular growths this edema frequently becomes so intense, within a few days time, as to shut off circulation sufficiently so that considerable diminution in the size of the mass is apparent macroscopically. This edema of the endothelial lining of the capillaries shows first because of the extreme sensitiveness of the endothelium to x-radiation or radium radiation. This edema completely occludes the lumen of the smaller vessels shutting off the circulation and ending in endarteritis obliterans. While this process is going on, the effect of radiation is demonstrable on the cells of the tumor showing first as a cloudy swelling of the nucleus and the cell, with later rupture of the nuclear membrane and the cell membrane and complete loss of cell identity. The reaction of the cells to the radiation and the reaction of the endothelial lining of the capillaries to radiation both go on to healing by fibrosis—this being the end result obtained by the treatment.

So far as the microscopical evidence is concerned, the effect of radium and x-rays on the tissues is the same. Clinically, however, we frequently see considerable difference in the effects of the two agents. For example: In the first case cited, the x-rays failed. For what reason we do not know, but one radium application resulted in complete cure. In the case of angiomata, radium seems to have a much more pronounced effect than x-ray. This is thought to be due to the apparently greater effect of radium on the endothelial lining of the blood vessels.

Fibrosis is nature's defense reaction against malignancy. This was shown by the investigations of MacCarthy of the Mayo Clinic a number of years ago. So carefully did he work this out that he can forecast the prognosis of carcinoma by determining the degree of fibrosis surrounding the growth. In connection with this investigation he has worked out a scheme by which carcinoma can be graded one, two, three or four, depending on the degree of organization present in the growth. The more organized the cells of the growth the greater their resistance to various forms of treatment.

Radium has certain advantages over x-ray which we think should be emphasized. One of these is the fact that the dosage with a given quantity of radium, through a given filter, under given technic, is always the same. In cases where it is possible to insert needles containing radium element or containing radon, a much more uniform distribution of the dosage through the tumor can be obtained than is possible with x-ray. Radium also has a great advantage in that it can be inserted into the body cavities making direct treatment of otherwise inaccessible growths possible. One of the disadvantages of radium treatment, in quantities which are had by the ordinary physician, is the fact that the reaction in the tissues adjacent to the radium is so much greater than that farther away. In fact the radium dosage decreases 50% in the first 2.5 cm. of tissue even with the heaviest filters which are customarily used.

On the other hand x-ray has advantages. In the first place it is less expensive than radium. It is also less dangerous to the operator because of the fact that when the electric current is shut off, the x-rays are stopped while radium rays are active whether the substance is being used in treatment or being handled by the operator. In the case of high voltage x-rays a more homogeneous dose can be introduced into the large deep-seated areas than is possible with the amount of radium possessed by most men. In only a few institutions where large quantities of radium are available can it be used above the body surface in a manner similar to x-rays. However, where a sufficient quantity is available for this type of use, it is even more satisfactory than the present day high voltage x-ray.

Considerable improvement has been made in the last few years in the high voltage x-ray treatment. This improvement is due to the application of the valve tube to the rectification of the alternating current, making direct current available for producing high voltage x-rays. Where this type of equipment is used, the time of treatment for the same dosage is reduced practically 50%. The dosage is more uniform because of the lack of variation and the more homogeneous radiation produced. A better depth dose is obtained. Furthermore the constitutional effects on the patient are greatly diminished by this type of equipment so that very few patients are nauseated by the treatment and seldom does vomiting occur.

It is our opinion that in all cases of radiation, either by radium or high voltage x-ray, that the dosage should be very carefully estimated before the treatment is given. If this is not done, too little dosage will be had in certain cases and too much in others. We find that the dosage very seldom is the same in different patients. This variation is due to the fact that the highly penetrating rays used pass completely through the body so that the thickness of the part and the depth of the tumor below the surface greatly change the dosage for each patient. Where careful technic is employed and the dosage is properly estimated little skin reaction is noticed and great benefit is obtained in various types of tumors, a few of which have been shown in the cases cited this morning.

EDITORIAL

ARCHIVES OF PHYSICAL THERAPY, X-RAY, RADIUM

1920 Annual Meeting in St. Louis.

IODINE RESEARCH PROGRAM

Since January 1, 1928, Mellon Institute of Industrial Research, Pittsburgh, Pa., has had in operation a Multiple Industrial Fellowship founded for the purpose of investigating the properties and uses of iodine. This fellowship, which is sustained by the Iodine Educational Bureau, 64 Water Street, New York, N. Y., is headed by Dr. George M. Karns, formerly a member of the chemical faculty of the University of Illinois. All results of the fellowship studies will be published.

Recently, through an additional appropriation from the fellowship donor, Mellon Institute, acting for the Iodine Fellowship, has made arrangements for the study of certain iodine problems in other institutions that have special facilities for such types of work. On October 7, 1929, a scholarship was founded at the Philadelphia College of Pharmacy and Science by a research grant from the institute. This scholarship—which, for the college year 1929-30, will be held by Mr. L. F. Tice—will have for its aim a broad investigation of vehicles and solvents for iodine, especially for external use in medicine. A large number of new organic chemicals will be studied as solvents with the object of evolving, if possible, a more satisfactory preparation than the alcoholic tincture now in use. The research, for which a definite program has been laid down, will be supervised by Professor Charles H. LaWall with the advisory collaboration of other faculty members of the Philadelphia College of Pharmacy and Science and with the direct cooperation of Dr. Karns. The investigational findings of the scholarship will be reported in the literature.

Another phase of the research includes a grant made on September 26, 1929, to the Pennsylvania State College for a comprehensive investigation—under the direction of Professor E. B. Forbes of the Institute of Animal Nutrition—of the nutritional place and value of iodine in the feeding of live stock. Despite the large mount of work which has been done on the role of iodine in metabolism, especially with reference to the thyroid, very little is known regarding the specific dietetic aspects of this element, particularly in the lower animals. Dr. Karns and his co-workers on the Iodine Fellowship of Mellon Institute are cooperating closely with Dr. Forbes and his staff, mainly by preparing standardized feeds. The findings of this research also will be made available to the public, in accordance with the Iodine Educational Bureau's policy of disseminating to every one interested the results of all investigations made under its aegis.

Mellon Institute is giving consideration to the founding of a research scholarship in a medical school for the purpose of aiding in the solution of incompletely answered questions respecting the utility of iodine in internal medicine. A number of pharmacologists are aiding the institute in determining a program for such pharmacodynamic inquiry.

NEW OFFICERS

At the recent annual meeting of the American College of Physical Therapy, the following officers were elected.

President—N. E. Titus, M.D., New York City.

President-Elect — Roy W. Fouts, M. D., Omaha.

First Vice President—F. H. Ewerhardt, M.D., St. Louis.

Second Vice President—Gustav Kolischer, M.D., Chicago.

Third Vice President—L. A. Tarbell, M.D., Battle Creek.

Fourth Vice President—J. S. Hibben, Pasadena.

Secretary—F. L. Wahrer, Marshalltown.

Treasurer—John F. Coulter, M.D., Chicago.

At the same time, the name of the organization was changed from the American College of Physical Therapy to the American Congress of Physical Therapy. The 1930 annual meeting will be held in St. Louis, the time to be determined later.

GRENZ RAY THERAPY

Dr. Gustav Bucky, recently of New York University and Bellevue Hospital, has been appointed chief of the x-ray department of Virchow Hospital in Berlin, to succeed his former teacher, Professor Levy-Dorn. Before he went to take up his new duties Dr. Bucky finished his new book, "Grenz Ray Therapy," which is being published by MacMillan. ($3.50.)

PHYSICAL THERAPY CHARTS

Six Physical Therapy Charts for studying, teaching and practicing physical therapy (x-ray and radium included). By Albert Bachem, Ph.D., professor of biophysics, University of Illinois, and Disraeli Kobak, M.D., assistant professor of medicine (physical therapy), Rush Medical College, University of Chicago. Published by E. Bachem, 1337 Winona St., Chicago.

(1) Biophysical foundations of physical therapy.
(2) Radium
(3) Roentgen- (x-) rays
(4) Light
(5) Diathermy (high frequency current)
(6) Electric currents.

SCHOLARSHIPS

HOSPITAL FOR JOINT DISEASES

Dr. J. J. Golub, director of the Hospital for Joint Diseases, one of the 59 member institutions of the United Hospital Fund, announces that Frederick Brown, the well-known philanthropist, has given the institution $100,000 for the establishment of two fellowships in orthopedic research at the hospital, of which he is president. The board of directors has accepted the gift and the fellowships will be known as the Mr. and Mrs. Frderick Brown Fellowships.

The income of the gift, approximating $4,800, will be awarded annually in sums of $2,400 each, to two research fellows. The awards will be made by a committee.

The committee will nominate two fellows each year, the selection being on a merit basis and the qualifications being essentially scholarship, previous training and research tendencies. The fellowships are open to all physicians and surgeons throughout the country, regardless of race, creed or color, who are graduates of Grade A medical schools, and who have had previous interneship in a hospital approved by the American Medical Association and the American College of Surgeons. The hospital invites candidates to submit applications. Each fellow appointed will submit a thesis on a laboratory or clinical research problem.

THE STUDENT'S LIBRARY

BOOKS REVIEWED

GRENZ RAY THERAPY. By *Gustav Bucky*, M.D., New York, with contributions by *Otto Glasser*, Ph.D., Cleveland, and *Olga Becker-Manheimer*, M.D., Hamburg. 170 pages. with 40 illutrations. New York: MacMillan Company.

This book is a translation of the original German text. It is characteristically well gotten up from a mechanical standpoint and contains all of the present-day knowledge concerning the subject upon which it is written.

The Grenz rays are very soft x-rays, very closely allied to the ultraviolet in their wave length and in their biological action upon tissues. The literature on the Grenz rays appeared first in 1910 and was quite voluminous until 1915, following which it entirely disappeared from the literature until revived by Bucky about 1925. Frank Schultz and his collaborator Zehden did the most in a therapeutic way.

The Grenz rays are produced by especially built vacuum tube with a hot cathode operating from a transformer delivering not more than 8 K. V. Due to the fact that they have so little penetration the tube must have a Lindemann glass window. This glass allows the rays to pass through so that they can be used on the skin for therapy. Because of their lack of penetration, distance filters them down very rapidly so that they must be used in close proximity or actual contact with the skin. The customary distance is 7 cm. This distance must be accurately measured in order to duplicate results.

In the chapter on the physics by Glasser, various physical measurements are reported and the waves definitely located in the spectrum. This is shown to be that portion of the spectrum extending from 1 to 3 Angstrom units. When used for therapy the effect on the skin is confined to the superficial layer. The reaction "is characterized by an early bright red color without rise in local heat. It is sharply circumscribed and appreciable exclusively to the eye, since the patient is unaware of it unless it is at a site which he can see. There is no edematous swelling. The unaided eye can detect no elevation above the normal skin surface. The hairs do not fall and are not more easily removable. The redness increases in 24 hours and reaches its height in another 24 hours. From now on the color becomes increasingly muddy, the forerunner of beginning pigmentation. This erythema lasts 2 or 3 weeks, whereupon it gradually fades, a clear pigmentation remains, which, on its part, and subject to the dose, persists for weeks or if the rays have been extremely soft, for months."

"Marked dryness always follows the erythema as a clinical sequela, with ultimate scaling. This desiccation of the normal as well as abnormal skin is striking and arises in the first few days. Itching, if present, goes rapidly, as a rule within a few hours. Further increase of the dosage produces vesicles or blebs."

Bucky states further, "that the most important and interesting effects of Grenz rays are : their influence on endocrine secretion, their antispastic and stimulating effects. Grenz ray treatment of skin and internal diseases never produces by-effects as roentgen rays do. We are convinced therefore that general treatment is as harmless as exposure to ultraviolet light. The Grenz rays, we find, are contra-indicated in two diseases—Basedow's and Hodgkin's."

The chapter on Grenz ray treatment of skin diseases discusses the various lesions which are benefited by the treatment and is well illustrated by photographs. The Grenz rays are especially valuable in the treatment of Nevus flammeus.—A. F. T.

ON PRESCRIBING PHYSICAL TREATMENT. By *Mathew B. Ray*, D.S.O., M.D. (Edin.). New York: William Wood and Company. 1929.

There has existed for some time a need for a small volume dealing with the high lights of physical treatment with special reference to methods of prescription. In this volume a good attempt has been made in compended form to inform the physician of the effects of the several physical agencies which are now more or less universally employed in the treatment of disease.

There are eight chapters in all with such subdivisions in each necessary for a coherent and systematic arrangement of the subject. While the definition of physical treatment as stated by the author may not meet with the approval of all those enthusiastically engaged in administering physical measures, it, nevertheless is comprehensive and must be interpreted in a broad sense. The author includes in physical treatment all methods based on the adaptation of the science of the properties and interrelations of matter and energy to the treatment of disease. He explains this by a more practical statement: "It therefore implies the utilization as remedies of all forms of heat and cold, however applied, all electrical curents, all kinds of radiant energy, such

as radium, the x-rays, ultraviolet rays, the visible rays of the sun, manipulations, exercises, etc."

It is clearly stated that this book is written entirely from the standpoint of the prescriber, and is not intended to be anything in the nature of a technical handbook. The subject-matter is dealt with under the following headings: (1) Surface thermal applications; (2) Massage and manipulations; (3) Electrical currents; ultraviolet irradiation. Due consideration is shown to a discussion of the anatomy and physiology of the skin. It is appropriately remarked at the outset that in dealing with the general principles on which are based the employment of hydrological and other physical measures in the treatment of disease, special attention must be directed towards the effects produced upon the skin as the organ primarily concerned.

An interesting and valuable tabulation in Chapter II is the comparative summary of the chief effects of cold and heat which is quoted from Kellogg's "Rational Hydrotherapy," but which bears quotation well in this section. The chapters on hydrotherapy are unusually well organized and presented in such form as to be of real value to the physician without delving into great details. Commencing with Chapter V and continuing for four chapters, light, heat and electricity as are commonly included in electrophysical therapy are described with reference always to the prescription. Even the employment of electrical current in diagnosis is discussed. The field is comprehensively covered, so far as our present knowledge goes.

In the description of each of the physical agents, the indications and contra-indications are stated. Dosage is always emphasized, while the technic of treatment seems, in most instances, to be in accord with current recognized methods. The index is detailed and completes a work which shows very obviously the expenditure of much effort in its compilation.

INTERNATIONAL ABSTRACTS

Amenorrhea During Serial Roentgen Exposures Due to Intervening Pregnancy. L. Goldstein & D. P. Murphy. Am. J. Obstet. & Gynec. 18:696-698, Nov., 1929.

The amenorrhea concurrent with a series of therapeutic roentgen exposures may be due to pregnancy. Conception may take place immediately before the first of a series of roentgen exposures, or may occur in the interval between any two of them. An embryo may be damaged by maternal pelvic irradiation and consequently develop into a mentally defective child.

The Advantages of Radiation in the Treatment of Cancer of the Cervix Uteri. M. Donaldson. Radiol. Rev. 51:483-486, Nov., 1929.

After careful consideration of the foregoing points, is it possible to come to any definite decision as to whether in the future hysterectomy is to be abandoned and treatment by radiation adopted in its stead? Personally, the writer believes it is, and he has definitely decided in favor of radiation, on the following grounds:

(1) The negligible mortality due to the treatment.

(2) The fact that statistics of survival rate are in one way inferior in the case of radiation to those following hysterectomy.

(3) By improving the technic of radiation treatment, the number of patients who seek advice early will be increased and the results will correspondingly improve.

(4) It will bring into general use radiation treatment for those cases which have passed the possibility of being completely restored to health. As a palliative measure in advanced cases there is no treatment whatever which is so beneficial.

(5) It will encourage the younger generation of gynecologists to adopt a method of treatment which the greater number will be able to carry out more successfully than Wertheim's operation. In this way also the average results of the treatment of carcinoma of the cervix will be improved.

Is Irradiated Farina as Bought in the Market Enriched with Vitamin D? F. W. Schultz, M. R. Ziegler. J. A. M. A. 93:1466-1468, Nov. 9, 1929.

Irradiated farina was fed to a series of rachitic rats for a period of ten and fifteen days in order to determine whether it is curative in rickets. The authors' results obtained from blood and bone analyses and roentgenograms do not indicate that any healing is obtained when treated farina, as purchased in the market, is incorporated as 10 per cent of the ration in a rachitic diet.

In view of the negative results obtained in this laboratory with irradiated farina, it does not seem possible that the claims made for it are worthy.

Report of Bone Sarcoma Treated by X-ray. G. E. Henschen. Texas St. J. Med. 24:852-853, April, 1929.

Every case of injury to a joint should have an x-ray examination. All malignant conditions should have the advantage of roentgen therapy, either as the principal treatment or as a supplement to other therapeutic agents.

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A

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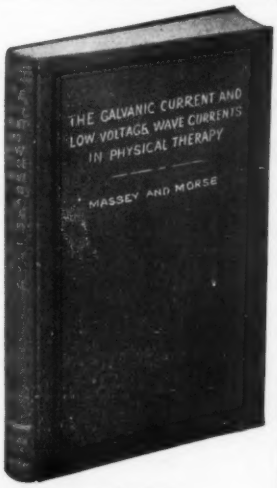

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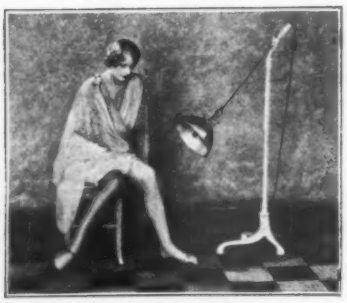

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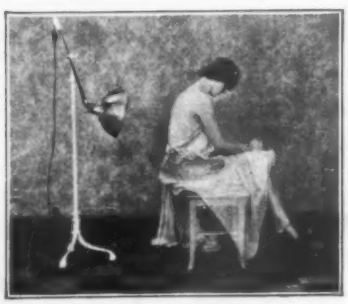

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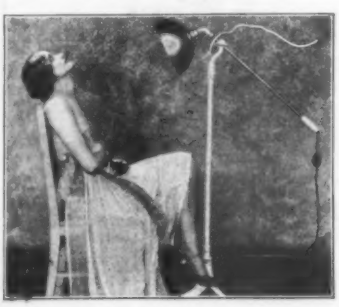
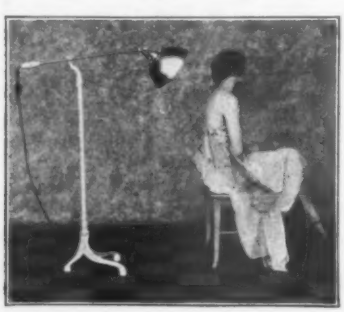


Position for treating over the chest. Adjustment bar slipped entirely back.



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